DICOM Conformance Statement

Product Name: *syngo*® Ultrasound Apps Suite
Release: VA17
Date: May 2020

https://www.siemens-healthineers.com/en-us/services/it-standards/dicom

SIEMENS Healthineers

1 CONFORMANCE STATEMENT OVERVIEW

The ***syngo* Ultrasound Apps Suite** supports the following DICOM Application Entities:

- Verification
  - Verification AE
- Transfer
  - Storage AE
- Query / Retrieve
  - Query AE
  - Retrieve AE

Table 1-1:
Network Services

SOP Classes	Service Class User (SCU)	Service Class Provider (SCP)
VERIFICATION		
Verification AE		
Verification	Yes	Yes
TRANSFER		
Storage AE		
Ultrasound Image Storage	Yes	Yes
Ultrasound Multi-frame Image Storage	Yes	Yes
Secondary Capture Image Storage	Yes	Yes
Comprehensive SR	Yes	Yes
Raw Data Storage	Yes	Yes
QUERY / RETRIEVE		
Query AE		
Study Root Query/Retrieve Information Model – FIND	Yes	No
Retrieve AE		
Study Root Query/Retrieve Information Model – MOVE	Yes	No

Table 1-2:
UID Values

SOP Class Name	SOP Class UID	Category
Verification AE		
Verification	1.2.840.10008.1.1	Verification
Storage AE		
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	Transfer
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	Transfer
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Transfer
Comprehensive SR	1.2.840.10008.5.1.4.1.1.88.33	Transfer
Raw Data Storage	1.2.840.10008.5.1.4.1.1.66	Transfer
Query AE		
Study Root Query/Retrieve Information Model – FIND	1.2.840.10008.5.1.4.1.2.2.1	Query / Retrieve
Retrieve AE		
Study Root Query/Retrieve Information Model – MOVE	1.2.840.10008.5.1.4.1.2.2.2	Query / Retrieve

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3 INTRODUCTION

This document describes the conformance to the ACR-NEMA DICOM 3.0 Standard by the *syngo* Ultrasound Apps Suite, version VA17 from Siemens Healthineers. It shall establish the conformance specifications for this system only, and does not apply to other products offered by Siemens Healthineers or its affiliates.

The *syngo* Ultrasound Apps Suite is a software program for use on a Picture Archiving and Communication System (PACS) workstation. With *syngo* Ultrasound Apps Suite, you can review the volume images from ACUSON SC2000™ volume imaging ultrasound system using the *syngo* Ultrasound Apps Suite controls that are also available on the ACUSON SC2000 system. You can also save 2D images derived from ACUSON SC2000 volume images to the PACS using *syngo* Ultrasound Apps Suite. These images can be sent using DICOM standard protocols and definitions to other DICOM compliant devices that support SOP classes as defined in Table 4-1: SOP Classes for Storage AE in this document.

The DICOM standard provides a well-defined set of structures and protocols that allow inter-operability of a wide variety of medical imaging devices. The *syngo* Ultrasound Apps Suite provides support for essential services related to ultrasound connectivity to DICOM compliant devices. The *syngo* Ultrasound Apps Suite will not support all features supported by the DICOM standard. This document clearly states the DICOM services and data classes that are supported by the applications included with the *syngo* Ultrasound Apps Suite. The intent of this document is to allow users and other vendors who also conform to the DICOM standard to exchange information within the specific context of those elements of the DICOM standard that the *syngo* Ultrasound Apps Suite supports.

This document is written with respect to the adopted portions of the DICOM standard, Version 3. The following sections of this document follow the outline specified in the DICOM Standard NEMA publication PS3.2.[1]

3.1 Audience

This document is written for the people that need to understand how the *syngo* Ultrasound Apps Suite will integrate into their healthcare facility. This includes both those responsible for overall imaging network policy and architecture, as well as integrators who need to have a detailed understanding of the DICOM features of the product. This document contains some basic DICOM definitions so that any reader may understand how this product implements DICOM features. However, integrators are expected to fully understand all the DICOM terminology, how the tables in this document relate to the product's functionality, and how that functionality integrates with other devices that support compatible DICOM features.

3.2 Remarks

The scope of this DICOM Conformance Statement is to facilitate integration between the *syngo* Ultrasound Apps Suite and other DICOM products. The Conformance Statement should be read and understood in conjunction with the DICOM Standard.

DICOM, by itself, does not guarantee interoperability. However, the Conformance Statement facilitates a first-level validation for interoperability between different applications supporting the same DICOM functionality as SCU and SCP, respectively.

This Conformance Statement is not intended to replace validation with other DICOM equipment to ensure proper exchange of information intended.

[1] Source: DICOM® Standards Publication Part 2, © NEMA. The DICOM Standard is under continuous maintenance. The current official version is available at http://dicom.nema.org.

The scope of this Conformance Statement is to facilitate communication with Siemens and other vendors' Medical equipment. The Conformance Statement should be read and understood in conjunction with the DICOM 3.0 Standard [1]. However, by itself it is not guaranteed to ensure the desired interoperability and a successful interconnectivity.

The user should be aware of the following important issues:

- The comparison of different conformance statements is the first step towards assessing interconnectivity.
- Test procedures should be defined and tests should be performed by the user to validate the connectivity desired. DICOM itself and the conformance parts do not specify this.
- The standard will evolve to meet the users' future requirements. Siemens is actively involved in developing the standard further and therefore reserves the right to make changes to its products or to discontinue its delivery.

Siemens reserves the right to modify the design and specifications contained herein without prior notice. Please contact your local Siemens representative for the most recent product information.

3.3 Terms and Definitions

Informal definitions are provided for the following terms used in this Conformance Statement. The DICOM Standard is the authoritative source for formal definition of these terms.

Abstract Syntax – The information agreed to be exchanged between applications, generally equivalent to a Service/Object Pair (SOP) Class. Examples: Verification SOP Class, Modality Worklist Information Model Find SOP Class, Computed Radiography Image Storage SOP Class.

ACUSON SC2000™ system – The volume imaging ultrasound system used with the *syngo*® SC2000™ Workplace; also referred to as the SC2000.

Application Entity (AE) – An end point of a DICOM information exchange, including the DICOM network or media interface software; i.e., the software that sends or receives DICOM information objects or messages. A single device may have multiple Application Entities.

Application Entity Title – The externally known name of an *Application Entity*, used to identify a DICOM application to other DICOM applications on the network.

Application Context – The specification of the type of communication used between *Application Entities*. Example: DICOM network protocol.

Association – A network communication channel set up between *Application Entities*.

Attribute – A unit of information in an object definition; a data element identified by a *tag*. The information may be a complex data structure (Sequence), itself composed of lower level data elements. Examples: Patient ID (0010,0020), Accession Number (0008,0050), Photometric Interpretation (0028,0004), Procedure Code Sequence (0008,1032).

Attribute Macro - A set of Attributes that are described in a single table that is referenced by multiple Module or other tables.

***syngo* Ultrasound Apps Suite** – A suite of ultrasound imaging applications for use on a PACS workstation.

Information Object Definition (IOD) – A data abstraction of a class of similar Real-World Objects which defines the nature and attributes relevant to the class of Real-World objects represented. Examples: MR Image IOD, CT Image IOD, Print Job IOD.

Integrating the Healthcare Enterprise (IHE) – An initiative sponsored by the Radiological Society of North America (RSNA) to document and demonstrate standards-based methods of sharing information in support of optimal patient care. For additional information, see www.rsna.org/ihe.

Functional Group - A set of logically related Attributes that are likely to vary together. May be used in Multi-frame IODs to describe parameters which change on a per frame basis.

Joint Photographic Experts Group (JPEG) – Joint Photographic Experts Group, The group was organized in 1986, issuing a standard in 1992, which was approved in 1994 as ISO 10918-1. The JPEG standard is used by DICOM applications.

Media Application Profile – The specification of DICOM information objects and encoding exchanged on removable media (e.g., CDs), see DICOM PS3.11.

Module – A set of *Attributes* within an *Information Object Definition* that are logically related to each other. Example: Patient Module includes (among others) Patient Name, Patient ID, Patient Birth Date, and Patient Sex.

Negotiation – First phase of *Association* establishment that allows *Application Entities* to agree on the types of data to be exchanged and how that data will be encoded.

Picture Archiving and Communications Systems (PACS) – A DICOM server that accepts medical images from another DICOM system and stores the images for later retrieval.

Presentation Context – The set of DICOM network services used over an *Association*, as negotiated between *Application Entities*; includes *Abstract Syntaxes* and *Transfer Syntaxes*.

Protocol Data Unit (PDU) – A packet (piece) of a DICOM message sent across the network. It contains protocol control information and user data. Devices must specify the maximum size packet they can receive for DICOM messages.

Request (RQ) – A request from one DICOM AE for service from another DICOM AE.

Response (RSP) – A response from one DICOM AE to the request for service from another DICOM AE.

Security Profile – A set of mechanisms, such as encryption, user authentication, or digital signatures, used by an *Application Entity* to ensure confidentiality, integrity, and/or availability of exchanged DICOM data.

Service Class Provider (SCP) – The role of an *Application Entity* that provides a DICOM network service; typically, a server that performs operations requested by another *Application Entity* (*Service Class User*). Examples: Picture Archiving and Communication System (image storage SCP, and image query/retrieve SCP), Radiology Information System (modality worklist SCP).

Service Class User (SCU) – The role of an *Application Entity* that uses a DICOM network service; typically, a client. Examples: imaging modality (image storage SCU, and modality worklist SCU), imaging workstation (image query/retrieve SCU).

Service/Object Pair (SOP) Class – The specification of the network or media transfer (service) of a particular type of data (object); the fundamental unit of DICOM interoperability specification. Examples: Ultrasound Image Storage Service, Basic Grayscale Print Management.

Service/Object Pair (SOP) Instance – An information object; a specific occurrence of information exchanged in a *SOP Class*. Examples: a specific x-ray image.

Structured Report (SR) – A DICOM object which contains measurement, calculations, diagnoses, image references, and other non-image information concerning a patient exam.

Tag – A 32-bit identifier for a data element, represented as a pair of four digit hexadecimal numbers, the "group" and the "element". If the "group" number is odd, the tag is for a private (manufacturer-specific) data element. Examples: (0010,0020) [Patient ID], (07FE,0010) [Pixel Data], (0019,0210) [private data element].

Transfer Syntax – The encoding used for exchange of DICOM information objects and messages. Examples: *JPEG* compressed (images), little endian explicit value representation.

Unique Identifier (UID) – A globally unique "dotted decimal" string that identifies a specific object or a class of objects; an ISO-8824 Object Identifier. Examples: Study Instance UID, SOP Class UID, SOP Instance UID.

Value Representation (VR) – The format type of an individual DICOM data element, such as text, an integer, a person's name, or a code. DICOM information objects can be transmitted with either explicit identification of the type of each data element (Explicit VR), or without explicit identification (Implicit VR); with Implicit VR, the receiving application must use a DICOM data dictionary to look up the format of each data element.

3.4 Basics of DICOM Communication

This section describes terminology used in this Conformance Statement for the non-specialist. The key terms used in the Conformance Statement are highlighted in *italics* below. This section is not a substitute for training about DICOM, and it makes many simplifications about the meanings of DICOM terms.

Two *Application Entities* (devices) that want to communicate with each other over a network using DICOM protocol must first agree on several things during an initial network "handshake". One of the two devices must initiate an *Association* (a connection to the other device), and ask if specific services, information, and encoding can be supported by the other device (*Negotiation*).

DICOM specifies a number of network services and types of information objects, each of which is called an *Abstract Syntax* for the Negotiation. DICOM also specifies a variety of methods for encoding data, denoted *Transfer Syntaxes*. The Negotiation allows the initiating Application Entity to propose combinations of Abstract Syntax and Transfer Syntax to be used on the Association; these combinations are called *Presentation Contexts.* The receiving Application Entity accepts the Presentation Contexts it supports.

For each Presentation Context, the Association Negotiation also allows the devices to agree on *Roles* – which one is the *Service Class User* (SCU - client) and which is the *Service Class Provider* (SCP - server). Normally the device initiating the connection is the SCU, i.e., the client system calls the server, but not always.

The Association Negotiation finally enables exchange of maximum network packet (*PDU*) size, security information, and network service options (called *Extended Negotiation* information).

The Application Entities, having negotiated the Association parameters, may now commence exchanging data. Common data exchanges include queries for worklists and lists of stored images, transfer of image objects and analyses (structured reports), and sending images to film printers. Each exchangeable unit of data is formatted by the sender in accordance with the appropriate *Information Object Definition*, and sent using the negotiated Transfer Syntax. There is a Default Transfer Syntax that all systems must accept, but it may not be the most efficient for some use cases. Each transfer is explicitly acknowledged by the receiver with a *Response Status* indicating success, failure, or that query or retrieve operations are still in process.

Two Application Entities may also communicate with each other by exchanging media (such as a CD-R). Since there is no Association Negotiation possible, they both use a *Media Application Profile* that specifies “pre-negotiated” exchange media format, Abstract Syntax, and Transfer Syntax.

3.5 Abbreviations

ACR	American College of Radiology
AE	DICOM Application Entity
AET	DICOM Application Entity Title
ASCII	American Standard Code for Information Interchange
CAP	Clinical Application Package
DB	Database
DCS	DICOM Conformance Statement
DSA	Digital Subtraction Angiography
FSC	File Set Creator
FSR	File Set Reader
FSU	File Set Updater
IIDC	Image-Intensifier Distortion Correction
IOD	DICOM Information Object Definition
ISO	International Standard Organization
LVA	left Ventricular Analysis
MPPS	Modality Performed Procedure Step
MWL	Modality Worklist
NEMA	National Electrical Manufacturers Association
O	Optional Key Attribute
PACS	Picture Archiving and Communication System
PDU	DICOM Protocol Data Unit
PISA	Proximal Isovelocity Surface Area
R	Required Key Attribute
RIS	Radiology Information System
SC	Storage Commitment
SCU	DICOM Service Class User (DICOM client)
SCP	DICOM Service Class Provider (DICOM server)
SOP	DICOM Service-Object Pair
SR	Structured Report
U	Unique Key Attribute
US	Ultrasound

3.6 References

[1] DICOM® Standards Publication, PS 3.1-2011 – PS 3.20-2011, © NEMA. The DICOM Standard is under continuous maintenance. The current official version is available at https://www.dicomstandard.org/.

[2] ACUSON SC2000 Volume Imaging Ultrasound System DICOM Conformance Statement. The DICOM Conformance Statement is under continuous maintenance.The current official version is available at https://www.siemens-healthineers.com/services/it-standards/dicom

4 NETWORKING

This section contains the *syngo* Ultrasound Apps Suite networking related services.

4.1 Implementation Model

syngo Ultrasound Apps Suite users can review the volume images of SC2000 system studies transferred to DICOM workstations and PACS archive servers on a network.

syngo Ultrasound Apps Suite Real World Activities are indicated by “Real World Activity” names while “*syngo* Ultrasound Apps Suite AE” indicates the invoked Application Entity. Similarly, the activities associated with DICOM service class providers are indicated as “Remote Real World Activity.”

4.1.1 Application Data Flow

Figure 4-1 and Figure 4-2 provide a functional overview of the *syngo* Ultrasound Apps Suite Application Entities (AE). Relationships are shown between user-invoked or local real-world activities (in the circles at the left of the AEs) and the external or remote real-world activities provided by DICOM service class providers (in the circles at the right of the AEs).

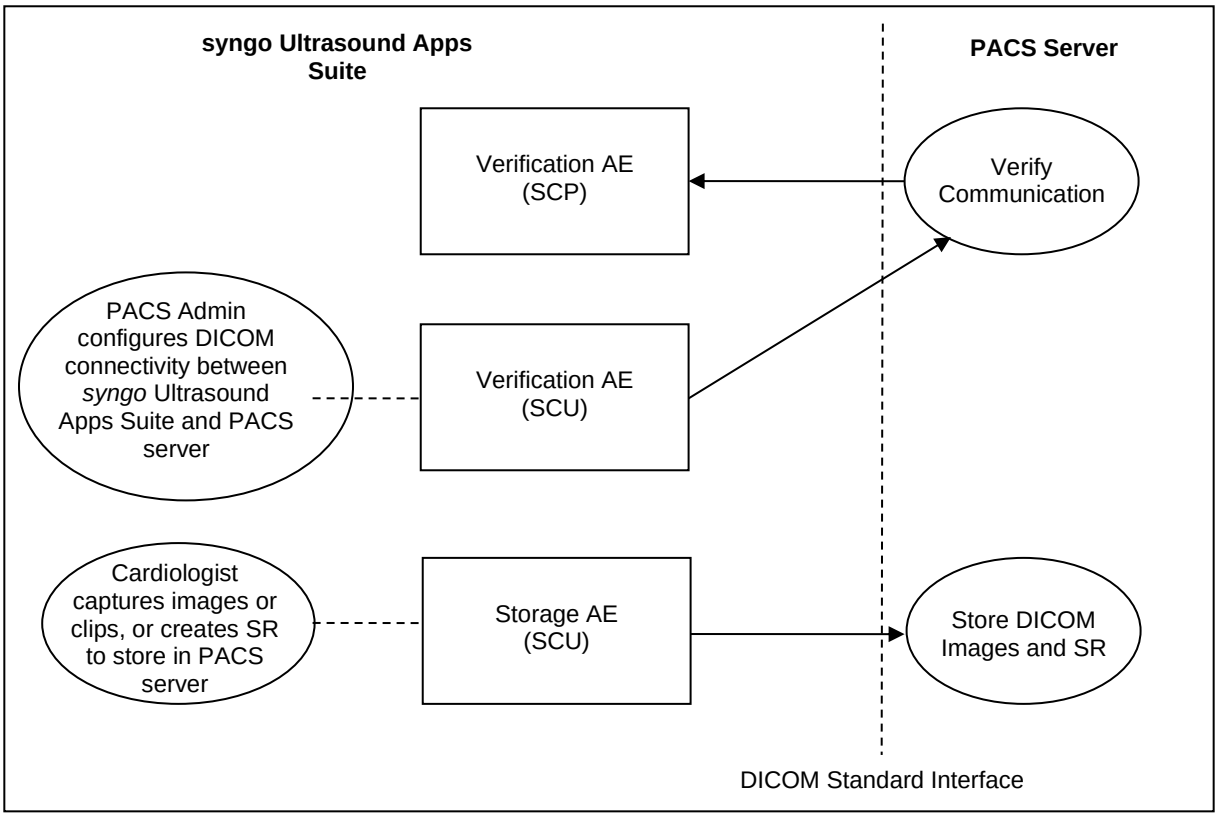

Figure 4-1. *syngo* Ultrasound Apps Suite Application Data Flow Diagram for Networking

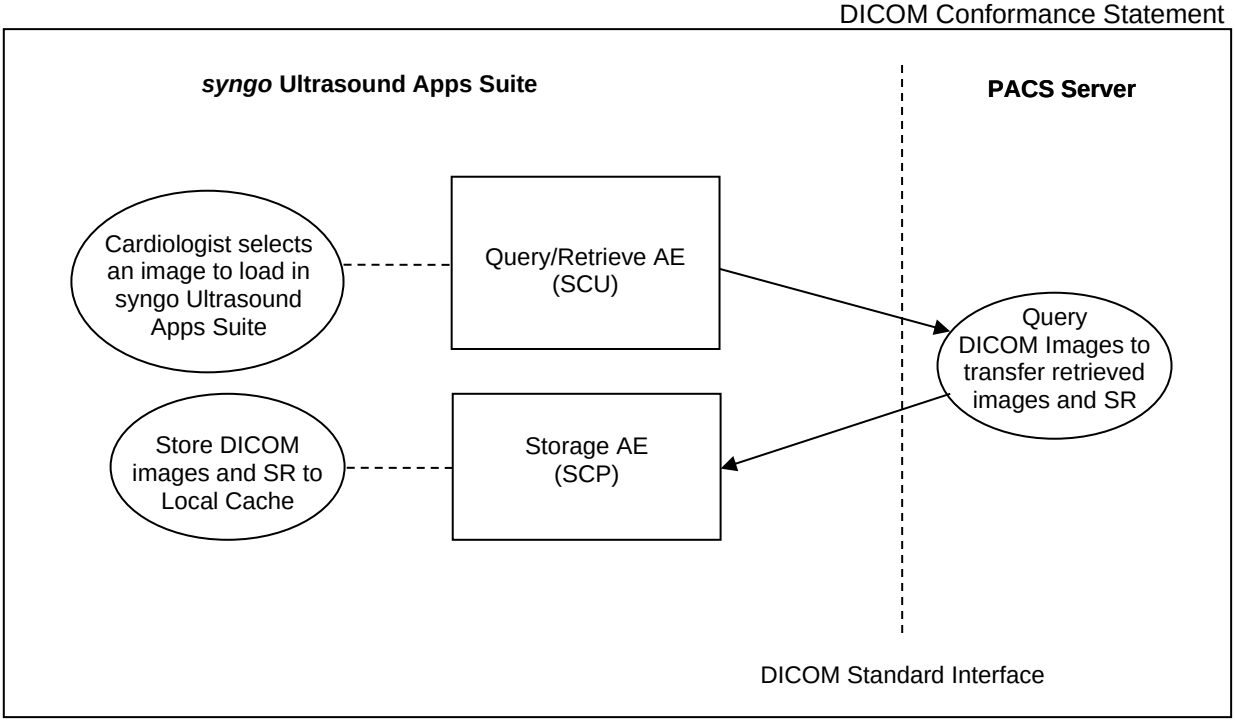

Figure 4-2. *syngo* Ultrasound Apps Suite Application Data Flow Diagram for Networking (Continued)

4.1.2 Functional Definition of AE's

The SCP components of the *syngo* Ultrasound Apps Suite operate as a background server process. They exist as soon as the system is powered up and wait for association requests. Upon accepting an association with a negotiated Presentation Context they start to receive and process the request described in the following sections.

The SCU components of the *syngo* Ultrasound Apps Suite are initiated by the user interaction.

4.1.2.1 Functional Definition of Verification AE

The DICOM verification service can be used for diagnostic purposes. When used as a diagnostic tool, Verification will return the following messages to the user:

- C-Echo test succeeded
- C-Echo failed

The *syngo* Ultrasound Apps Suite supports the Verification service as a SCP and SCU. As an SCU, Verification is activated when the C-Echo button is selected in the *syngo* Ultrasound Apps Suite DICOM Configuration tool.

4.1.2.2 Functional Definition of Storage AE

The *syngo* Ultrasound Apps Suite acts as SCU and SCP for the DICOM C-STORE network service.

As an SCU, the *syngo* Ultrasound Apps Suite Storage Application Entity originates associations for the transfer of DICOM Ultrasound single frame images, multi-frame images, raw data objects, and Comprehensive Structured Reports to remote Application Entities. The system supports manual storage of captured objects. Manual transfers can be initiated through the Save Data option during the End Exam and a list of DICOM objects stores to PACS server by transferring one object after another. In the event of a transfer failure while saving data to a PACS server, the Storage SCU continues transferring the next object from a list of DICOM objects captured in *syngo* Ultrasound Apps Suite to the end of the study. Objects failed during the DICOM transfer will be kept in the Local Cache without retries. The Local Cache will be cleaned up based on the *syngo* Ultrasound Apps Suite Local Cache management policy.

The storage request consists of data describing the composite image and SR objects selected for storage and the destination AET. An association is negotiated with the destination AE and the object data is transferred using the C-STORE DIMSE Service. The transfer status is reported to the initiator of the Storage request.

As an SCP, the *syngo* Ultrasound Apps Suite Storage Application Entity accepts storage requests from configured DICOM nodes and stores received objects into the Local Cache. The C-STORE DIMSE service is used for storing the images. It also can respond to external verification requests for C-ECHO requests.

4.1.2.3 Functional Definition of Query/Retrieve AE

The query/retrieve service class defines an application-level class of services which facilitates the management of images and patient data against the well-defined information model of DICOM and allows a DICOM AE to retrieve images and SRs from a remote DICOM node or to request a remote DICOM AE to initiate a transfer of images and SRs to another DICOM AE. The *syngo* Ultrasound Apps Suite DICOM query/retrieve Application Entity supports the query/retrieve services as an SCU.

The Query SCU initiates a C-FIND request to the remote SCP and is invoked directly by the user, using the query parameters from the user selected image in the data load workflow. The remote Query SCP returns a list of responses with defined data, which are processed by *syngo* Ultrasound Apps Suite to start retrieval.

The *syngo* Ultrasound Apps Suite supports

- Study Root Query/Retrieve Model.

As the Move SCU, the system initiates a C-MOVE request to the remote Retrieve SCP. The remote Retrieve SCP in turn starts C-STORE suboperations to the *syngo* Ultrasound Apps Suite Storage SCP.

4.1.3 Sequencing of Real-World Activities

This section describes the sequencing of Real-World Activities performed by the Application Entities using a UML sequence diagram. Real-World Activities are depicted as vertical bars and arrows show the events exchanged between them.

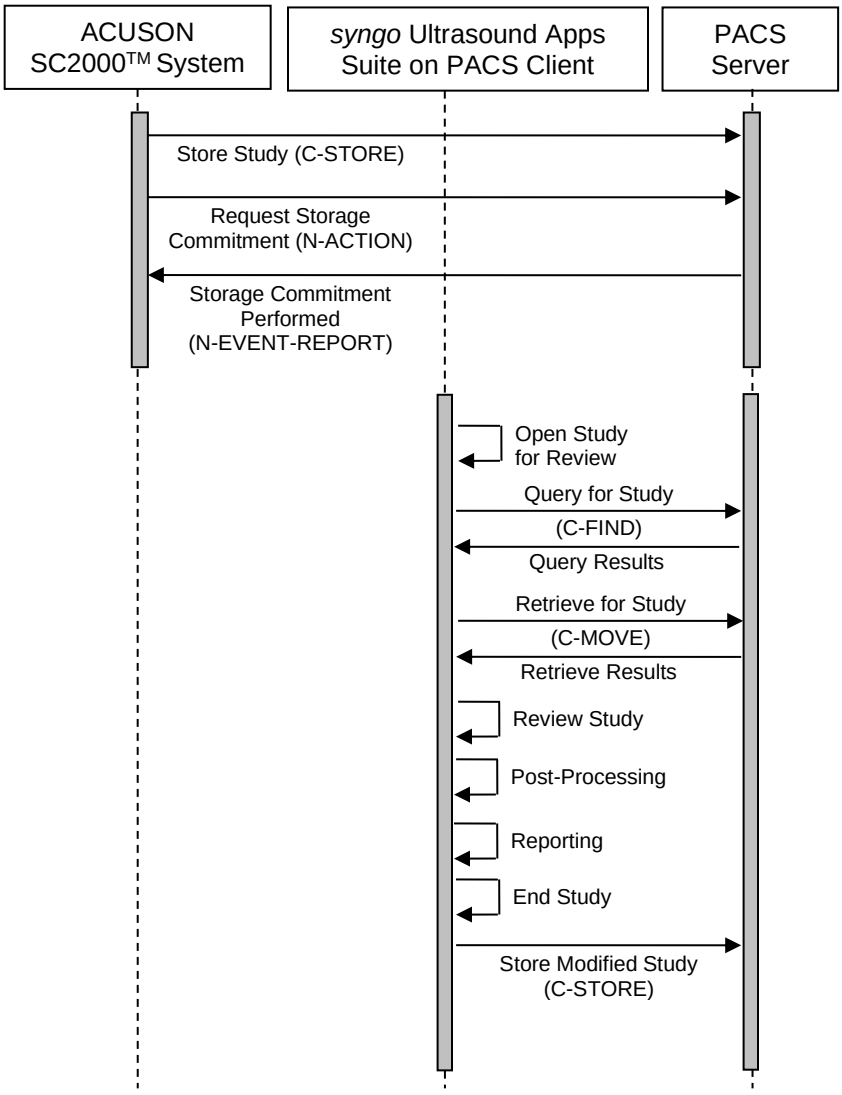

Figure 4-3. Sequence Diagram for Real-World Activities

4.2 AE Specifications

4.2.1 Storage AE Specification

4.2.1.1 SOP Classes

Table 4-1:
SOP Classes for Storage AE

SOP Class Name	SOP Class UID	User of Service (SCU)	Provider of Service (SCP)
Verification	1.2.840.10008.1.1	Yes	Yes
Supported Storage SOP Classes			
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	Yes	Yes
Ultrasound Multi-frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	Yes	Yes
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Yes	Yes
Comprehensive SR	1.2.840.10008.5.1.4.1.1.88.33	Yes	Yes
Raw Data Storage	1.2.840.10008.5.1.4.1.1.66	Yes	Yes

4.2.1.2 Association Policies

4.2.1.2.1 General

Table 4-2:
DICOM Application Context

Application Context Name	1.2.840.10008.3.1.1.1

4.2.1.2.2 Number of Associations

The *syngo* Ultrasound Apps Suite does not impose any limit on the number of simultaneous associations that can be requested or accepted. The only limitation on the number of simultaneous associations is imposed by the operating system and available resources.

4.2.1.2.3 Asynchronous Nature

The *syngo* Ultrasound Apps Suite does not currently support asynchronous communication (multiple outstanding transactions over a single association).

4.2.1.2.4 Implementation Identifying Information

Table 4-3:
DICOM Implementation Class and Version for Storage AE

Implementation Class UID	1.3.12.2.1107.5.5.14.20120101
Implementation Version Name	SIEMENS

4.2.1.3 Association Initiation Policy (Storage SCU)

The *syngo* Ultrasound Apps Suite initiates associations while processing the service operations and internal messages as shown below.

Operation or Real-World Activity	Association for
Send Instances	C-STORE

4.2.1.3.1 Activity "Send Instances"

4.2.1.3.1.1 Description and Sequencing of Activities

Sending a DICOM object is initiated by the *syngo* Ultrasound Apps Suite user in the data save workflow.

If an association to a remote Application Entity could successfully be established, each image will be transferred one after another via the same open association. In the event of a network failure, there is no retry mechanism for images failed to transfer.

4.2.1.3.1.2 Proposed Presentation Contexts

Any of the Presentation Contexts shown in the following table are proposed to the Storage SCU AE for sending images.

Table 4-4:
Proposed Presentation Contexts by Storage AE

Abstract Syntax		Transfer Syntax	
Name	**UID**	**Name List**	**UID List**
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	Implicit VR Little Endian	1.2.840.10008.1.2
		Explicit VR Little Endian	1.2.840.10008.1.2.1
		JPEG Lossy (Baseline)	1.2.840.10008.1.2.4.50
		JPEG Lossless	1.2.840.10008.1.2.4.70
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Implicit VR Little Endian	1.2.840.10008.1.2
		Explicit VR Little Endian	1.2.840.10008.1.2.1
Ultrasound Multi-frame Image Storage (Clips)	1.2.840.10008.5.1.4.1.1.3.1	Implicit VR Little Endian	1.2.840.10008.1.2
		Explicit VR Little Endian	1.2.840.10008.1.2.1
		JPEG Lossy (Baseline)	1.2.840.10008.1.2.4.50
		JPEG Lossless	1.2.840.10008.1.2.4.70
Ultrasound Raw Data Storage (3D volumetric data sets)	1.2.840.10008.5.1.4.1.1.66	Implicit VR Little Endian	1.2.840.10008.1.2
		Explicit VR Little Endian	1.2.840.10008.1.2.1
Comprehensive SR	1.2.840.10008.5.1.4.1.1.88.33	Implicit VR Little Endian	1.2.840.10008.1.2
		Explicit VR Little Endian	1.2.840.10008.1.2.1

4.2.1.3.1.3 Photometric Interpretation

Photometric Interpretation (color mode of the pixel image data) is not a negotiable parameter in DICOM 3.0. The Photometric Interpretation Attribute (0028,0004) is set depending on the transfer syntax and the system configuration.

Table 4-5:
Photometric Interpretation

SOP Class		Transfer Syntax		Photometric Interpretation
Name	**UID**	**Name List**	**UID List**	
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	Implicit VR Little Endian	1.2.840.10008.1.2	RGB
		Explicit VR Little Endian	1.2.840.10008.1.2.1	
		JPEG Lossless	1.2.840.10008.1.2.4.70	
		JPEG Lossy (Baseline)	1.2.840.10008.1.2.4.50	YBR_FULL_422
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Implicit VR Little Endian	1.2.840.10008.1.2	RGB
		Explicit VR Little Endian	1.2.840.10008.1.2.1	
Ultrasound Multi-frame Image Storage (Clips)	1.2.840.10008.5.1.4.1.1.3.1	Implicit VR Little Endian	1.2.840.10008.1.2	RGB
		Explicit VR Little Endian	1.2.840.10008.1.2.1	
		JPEG Lossless	1.2.840.10008.1.2.4.70	
		JPEG Lossy (Baseline)	1.2.840.10008.1.2.4.50	YBR_FULL_422

4.2.1.3.1.4 SOP Specific Conformance for Storage SOP Classes

The *syngo* Ultrasound Apps Suite will not add or change private attributes, even if case objects are compressed or the image header is updated according to IHE [2] Patient Information Reconciliation.

The Storage SCU AE will exhibit the following behavior according to the Status Code value returned in a C-STORE Response from a remote storage SCP AE:

Table 4-6:
Storage SCU AE C-STORE Response Status Handling Behavior

Service Status	Further Meaning	Error Code	Behavior
Success	Image is successfully stored on file system	0000	Success indication message is output to the Service Logs. No message is posted to the User Interface.
Error	Out of Resources	A7xx	This is treated as a permanent Failure. Failure reported to user. Error indication message is output to the Service Logs.
Error	Data Set does not match SOP Class	A9xx	This is treated as a permanent Failure. Failure reported to user. Error indication message is output to the Service Logs.
Error	Cannot Understand	Cxxx	This is treated as a permanent Failure. Failure reported to user. Error indication message is output to the Service Logs.
Error	Failure unable to process	0110	This is treated as a permanent Failure. Failure reported to user. Error indication message is output to the Service Logs.
Warning	Coercion of Data Elements	B000	Image transmission is considered successful. Warning indication message is output to the Service Logs. No message is posted to the User Interface.
Warning	Data Set does not match SOP Class	B007	Image transmission is considered successful. Warning indication message is output to the Service Logs. No message is posted to the User Interface.

Service Status	Further Meaning	Error Code	Behavior
Warning	Elements Discarded	B006	Image transmission is considered successful. Warning indication message is output to the Service Logs. No message is posted to the User Interface.
*	*	Any other status code.	This is treated as a permanent Failure. Failure reported to user. Error indication message is output to the Service Logs.

All Status Codes indicating an error or refusal are treated as a permanent failure. The Storage SCU AE never automatically resends images when an error Status Code is returned in a C-STORE Response.

Table 4-7:
Storage SCU AE Communication Failure Behavior

Exception	Behavior
Timeout expiry for an expected DICOM Message Response (DIMSE level timeout).	Failure reported to user (Timeout configurable; default 30 seconds). Error indication message is output to the Service Logs.
Timeout expiry for an expected DICOM PDU or TCP/IP packet (Low-level timeout).	Failure reported to user (Timeout configurable; default 30 seconds). Error indication message is output to the Service Logs.
Association Aborted by the SCP or the network layers indicate communication loss (i.e. low-level TCP/IP socket closure)	Failure reported to user and the storage job is cancelled. Error indication message is output to the Service Logs.

4.2.1.4 Association Acceptance Policy (Storage SCP)

The *syngo* Ultrasound Apps Suite accepts a new association while processing the service operations and internal messages as shown below.

Operation or Real-World Activity	Association for
Receive Instances	C-STORE, C-ECHO

Generally, associations are accepted if all of the following conditions are true:

- The "called AET" matches the configured Application Entity Titles of the *syngo* Ultrasound Apps Suite.
- The maximum number of threads is not reached.
- At least one Proposed Presentation Context is supported.

If a Proposed Presentation Context contains more than one Transfer Syntax, the one in the following priority list is chosen (if applicable for the SOP class):

1) JPEG Lossless, Non-Hierarchical, First-Order Prediction (Process 14)
2) JPEG Baseline (Process 1)
3) Explicit Value Representation Little Endian
4) Implicit Value Representation Little Endian

4.2.1.4.1 Activity "Receive Instances"

4.2.1.4.1.1 Description and Sequencing of Activities

Receiving a DICOM object is initiated by the *syngo* Ultrasound Apps Suite user in the data load workflow. The *syngo* Ultrasound Apps Suite Storage Application Entity will accept an association, receive any images transmitted on that association and store the images on disk.

The Storage SCP AE accepts Associations only if they have valid Presentation Contexts. If none of the requested Presentation Contexts are accepted, then the Association Request itself is rejected.

4.2.1.4.1.2 Accepted Presentation Contexts

Any of the Presentation Contexts shown in the following table are acceptable to the Storage SCP AE for receiving images.

Table 4-8:
Accepted Presentation Contexts by Storage AE

Abstract Syntax		Transfer Syntax	
Name	**UID**	**Name List**	**UID List**
Verification	1.2.840.10008.1.1	Implicit VR Little Endian	1.2.840.10008.1.2
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	Implicit VR Little Endian	1.2.840.10008.1.2
		Explicit VR Little Endian	1.2.840.10008.1.2.1
		JPEG Lossy (Baseline)	1.2.840.10008.1.2.4.50
		JPEG Lossless	1.2.840.10008.1.2.4.70
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Implicit VR Little Endian	1.2.840.10008.1.2
		Explicit VR Little Endian	1.2.840.10008.1.2.1
		JPEG Lossy (Baseline)	1.2.840.10008.1.2.4.50
		JPEG Lossless	1.2.840.10008.1.2.4.70
Ultrasound Multi-frame Image Storage (Clips)	1.2.840.10008.5.1.4.1.1.3.1	Implicit VR Little Endian	1.2.840.10008.1.2
		Explicit VR Little Endian	1.2.840.10008.1.2.1
		JPEG Lossy (Baseline)	1.2.840.10008.1.2.4.50
		JPEG Lossless	1.2.840.10008.1.2.4.70
Raw Data Storage (Siemens SC2000 volumetric data sets [2])	1.2.840.10008.5.1.4.1.1.66	Implicit VR Little Endian	1.2.840.10008.1.2
		Explicit VR Little Endian	1.2.840.10008.1.2.1
Comprehensive SR	1.2.840.10008.5.1.4.1.1.88.33	Implicit VR Little Endian	1.2.840.10008.1.2
		Explicit VR Little Endian	1.2.840.10008.1.2.1

4.2.1.4.1.3 SOP Specific Conformance for Verification SOP Class

The Storage SCP AE provides standard conformance to the Verification SOP Class as an SCP.
If the C-ECHO request was successfully received, a 0000 (Success) status code will be returned in the C-ECHO response. Otherwise, the assocation will be aborted.

4.2.1.4.1.4 SOP Specific Conformance for Storage SOP Classes

In case of a successful C-STORE operation, the image has successfully been written on disk in its accepted transfer syntax. The Storage AE of the *syngo* Ultrasound Apps Suite returns the status "success" when the data is stored to disk.

Table 4-9:
Storage SCP AE C-STORE Response Status

Service Status	Further Meaning	Error Code	Reason
Success	Success	0000	The Composite SOP Instance was successfully received, verified, and stored in the local file system. Success indication message is output to the Service Logs.
Error	Failure unable to process	0110	This is treated as a permanent Failure. The SOP Instance will not be saved. Error indication message is output to the Service Logs.
Error	Out of Resources	A700	Indicates that there was not enough disk space to store the image. The SOP Instance will not be saved. Error indication message is output to the Service Logs.
Error	Invalid Data Set	A900	This is treated as a permanent Failure. The SOP Instance will not be saved. Error message is output to the Service Log.

NOTE: If a failure condition does occur when handling an Association then all images previously received successfully over the Association are maintained in the Local Cache. No previously successfully received images are discarded. Even if an image is successfully received but an error occurs transmitting the C-STORE Response then this final image is maintained rather than discarded. If the loss of an Association is detected then the Association is closed.

The Behavior of Storage SCP AE during communication failure is summarized in the following table:

Table 4-10:
Storage SCP AE Communication Failure Behavior

Exception	Behavior
Timeout expiry for an expected DICOM Message Response (DIMSE level timeout).	Error indication message is output to the Service Logs (Timeout configurable; default 30 seconds).
Timeout expiry for an expected DICOM PDU or TCP/IP packet (Low-level timeout).	Error indication message is output to the Service Logs (Timeout configurable; default 30 seconds).
Association Aborted by the SCU or the network layers indicate communication loss (i.e. low-level TCP/IP socket closure)	Error indication message is output to the Service Logs.

4.2.1.4.1.5 Other SOP Specific Behavior

- If an image is received that is already stored in the Local Cache – identified by the SOP Instance UID – the new image will be ignored. The existing instance is not superseded.

4.2.2 Query AE Specification

4.2.2.1 SOP Classes

The *syngo* Ultrasound Apps Suite provides Standard Conformance to the following DICOM V3.0 SOP Classes as an SCU.

Table 4-11:
SOP Classes for Query AE

SOP Class Name	SOP Class UID	User of Service (SCU)	Provider of Service (SCP)
Supported Query SOP Classes			
Study Root Query/Retrieve Information Model - FIND	1.2.840.10008.5.1.4.1.2.2.1	Yes	No

4.2.2.2 Association Policies

4.2.2.2.1 General

Table 4-12:
DICOM Application Context

Application Context Name	1.2.840.10008.3.1.1.1

4.2.2.2.2 Number of Associations

The *syngo* Ultrasound Apps Suite does not impose any limit on the number of simultaneous associations that can be requested or accepted. The only limitation on the number of simultaneous associations is imposed by the operating system and available resources.

4.2.2.2.3 Asynchronous Nature

The *syngo* Ultrasound Apps Suite does not currently support asynchronous communication (multiple outstanding transactions over a single association).

4.2.2.2.4 Implementation Identifying Information

Table 4-13:
DICOM Implementation Class and Version for Query AE

Implementation Class UID	1.3.12.2.1107.5.5.14.20120101
Implementation Version Name	SIEMENS

4.2.2.3 Association Initiation Policy (Query SCU)

The *syngo* Ultrasound Apps Suite will initiate new associations for the following operations as an SCU.

Operation or Real–World Activity	Association for
Querying a Remote Node	C-FIND

4.2.2.3.1 Activity “Querying a Remote Node”

4.2.2.3.1.1 Description and Sequencing of Activities

The associated Real-World activity is a C-Find request initiated by the user of the *syngo* Ultrasound Apps Suite in the data load workflow. The query attributes are set from the user selected image to query a PACS server. If the query successfully establishes an association to the remote Application Entity, it will send a C-Find request (according to the query model) and will then return the results to the *syngo* Ultrasound Apps Suite for a retrieval operation.

4.2.2.3.1.2 Proposed Presentation Contexts

The *syngo* Ultrasound Apps Suite will propose Presentation Contexts as shown in the following table.

Table 4-14:
Proposed Presentation Contexts by Query AE

Presentation Context Table

Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Study Root Query/ Retrieve Information Model - FIND	1.2.840.10008.5.1.4.1.2.2.1	Implicit VR Little Endian Explicit VR Little Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCU	No

4.2.2.3.1.3 SOP Specific Conformance to Query SOP Class

The *syngo* Ultrasound Apps Suite supports the following query levels:

- Study
- Series
- Instance

Refer to section 8.1.1.6 Query: C-Find, for a detailed list of attributes.

The *syngo* Ultrasound Apps Suite Query AE checks for the following status codes in the Query SCP's C-FIND Response.

Table 4-15:
Query SCU AE C-FIND Response Status Handling Behavior

Service Status	Further Meaning	Error Code	Behavior
Success	Matching is complete	0000	Success indication message with the matched identifier is output to the Service Logs. No message is posted to the User Interface.
Error	No Auto Retry on failure	Any non-Success and non-Pending Code	Failure reported to user. Error indication message is output to the Service Logs.
Pending	Matches are continuing	FF00-FF01	N/A

Table 4-16:
Query SCU AE Communication Failure Behavior

Exception	Behavior
Timeout expiry for an expected DICOM Message Response (DIMSE level timeout).	Failure reported to user (Timeout configurable; default 30 seconds). Error indication message is output to the Service Logs.
Timeout expiry for an expected DICOM PDU or TCP/IP packet (Low-level timeout).	Failure reported to user (Timeout configurable; default 30 seconds). Error indication message is output to the Service Logs.
Association Aborted by the SCP or the network layers indicate communication loss (i.e. low-level TCP/IP socket closure)	Failure reported to user. Error indication message is output to the Service Logs.

4.2.2.4 Association Acceptance Policy

Query AE does not accept Association requests.

4.2.3 Retrieve AE Specification

4.2.3.1 SOP Classes

This Application Entity provides Standard Conformance to the following SOP Classes.

Table 4-17:
SOP Classes for Retrieve AE

SOP Class Name	SOP Class UID	User of Service (SCU)	Provider of Service (SCP)
Supported Retrieve SOP Classes			
Study Root Query/Retrieve Information Model - MOVE	1.2.840.10008.5.1.4.1.2.2.2	Yes	No

4.2.3.2 Association Policies

4.2.3.2.1 General

Table 4-18:
DICOM Application Context

Application Context Name	1.2.840.10008.3.1.1.1

4.2.3.2.2 Number of Associations

The *syngo* Ultrasound Apps Suite does not impose any limit on the number of simultaneous associations that can be requested or accepted. The only limitation on the number of simultaneous associations is imposed by the operating system and available resources.

4.2.3.2.3 Asynchronous Nature

The *syngo* Ultrasound Apps Suite does not currently support asynchronous communication (multiple outstanding transactions over a single association).

4.2.3.2.4 Implementation Identifying Information

Table 4-19:
DICOM Implementation Class and Version for Retrieve AE

Implementation Class UID	1.3.12.2.1107.5.5.14.20120101
Implementation Version Name	SIEMENS

4.2.3.3 Association Initiation Policy (Retrieve SCU)

The *syngo* Ultrasound Apps Suite will initiate new associations for the following operations as an SCU.

Operation or Real–World Activity	Association for
Retrieving Instances	C-MOVE

4.2.3.3.1 Activity “Retrieving Instances”

4.2.3.3.1.1 Description and Sequencing of Activities

The *syngo* Ultrasound Apps Suite Retrieve AE receives the query result to send a C-MOVE request to an SCP node to retrieve an image, a series or a study.

4.2.3.3.1.2 Accepted Presentation Contexts

The *syngo* Ultrasound Apps Suite will accept Presentation Contexts as shown in the following table.

Table 4-20:
Accepted Presentation Contexts by Retrieve AE

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Study Root Query/Retrieve Model – MOVE	1.2.840.10008.5.1.4.1.2.2.2	Implicit VR Little Endian Explicit VR Little Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCU	No

4.2.3.3.1.3 SOP Specific Conformance to Retrieve SOP Class

At association establishment time, the C-MOVE presentation context shall be negotiated. When the C-MOVE request is processed, the Move Destination attribute (receiver of images) is required to be set and the Move Destination AE must conform to the DICOM conventions (value representation AE).

Table 4-21:
Retrieve SCU AE C-MOVE Response Status Handling Behavior

Service Status	Further Meaning	Error Code	Behavior
Success	Matching is complete	0000	Success indication message is output to the Service Logs. No message is posted to the User Interface.

Service Status	Further Meaning	Error Code	Behavior
Error	No Auto Retry on failure	Any non-Success, non-Pending and non-Warning Code	Failure reported to user. Error indication message is output to the Service Logs.
Pending	Sub-operations are continuing	FF00	Retrieving-in-progress reported to user. Pending indication message is output to the Service Logs.
Warning	Sub-operations Complete – One or more Failures	B000	Warning indication message is output to the Service Logs. No message is posted to the User Interface.

Table 4-22:
Retrieve SCU AE Communication Failure Behavior

Exception	Behavior
Timeout expiry for an expected DICOM Message Response (DIMSE level timeout).	Failure reported to user (Timeout configurable; default 30 seconds). Error indication message is output to the Service Logs.
Timeout expiry for an expected DICOM PDU or TCP/IP packet (Low-level timeout).	Failure reported to user (Timeout configurable; default 30 seconds). Error indication message is output to the Service Logs.
Association Aborted by the SCP or the network layers indicate communication loss (i.e. low-level TCP/IP socket closure)	Failure reported to user. Error indication message is output to the Service Logs.

4.2.3.4 Association Acceptance Policy

Retrieve AE does not accept Association requests.

4.3 Network Interfaces

4.3.1 Physical Network Interface

The *syngo* Ultrasound Apps Suite is independent from the physical medium over which TCP/IP executes; it inherits this from the OS system upon which it executes.

4.3.2 Additional Protocols

None.

4.3.3 IPv4 and IPv6 Support

The *syngo* Ultrasound Apps Suite is configured to IPv4 supported, IPv6 not supported.

4.4 Configuration

DICOM and networking parameters can be configured for both the local *syngo* Ultrasound Apps Suite and remote DICOM Service Class Providers through the *syngo* Ultrasound Apps Suite DICOM Configuration tool.

4.4.1 AE Title/Presentation Address Mapping

4.4.1.1 Local AE Titles

The mapping from AE Title to TCP/IP addresses and ports is configurable and set at the time of installation by Installation Personnel. The *syngo* Ultrasound Apps Suite Application Entities have the same AE Title which can be configured for the *syngo* Ultrasound Apps Suite in the following parameters:

- Host Name/IP address
- DICOM Application Entity Titles
- Port Number

4.4.1.2 Remote AE Title/Presentation Mapping

Remote DICOM Verification, Storage and Query/Retrieive Service Class Providers are configured in the following parameters for the PACS server:

- Host name/IP address
- DICOM Application Entity Title
- Port number

4.4.2 Parameters

Table 4-23:
Configuration Parameters

Parameter	Configurable	Default Value
General Parameters		
Maximum PDU Size	Yes	64234 bytes
Time-out waiting for acceptance or rejection response to an Association Open Request. (Application Level timeout)	Yes	15 seconds
General DIMSE level timeout values (Note that this is the "Network Timeout" in the *syngo* Ultrasound Apps Suite DICOM Configuration tool)	Yes	30 seconds
Time-out waiting for response to TCP/IP connect request. (Low-level timeout)	Yes	15 seconds
Time-out waiting for acceptance of a TCP/IP message over the network. (Low-level timeout)	Yes	15 seconds
Time-out for waiting for data between TCP/IP packets. (Low-level timeout)	Yes	15 seconds
Time-out waiting for A-ASSOCIATE RQ PDU on open TCP/IP connection. (ARTIM timeout)	Yes	30 seconds
Maximum number of outstanding connection requests per listener socket	Yes	5
The TCP/IP socket buffer size to improve network performance. (Note that this is not the "Maximum number of simultaneous associations")	Yes	131400 bytes
Storage SCP AE Parameters		
Maximum number of threads	No	50
Query SCU AE Parameters		
Maximum number of query responses	No	100

5 MEDIA INTERCHANGE

5.1 Implementation Models

5.1.1 Application Data Flow Diagram

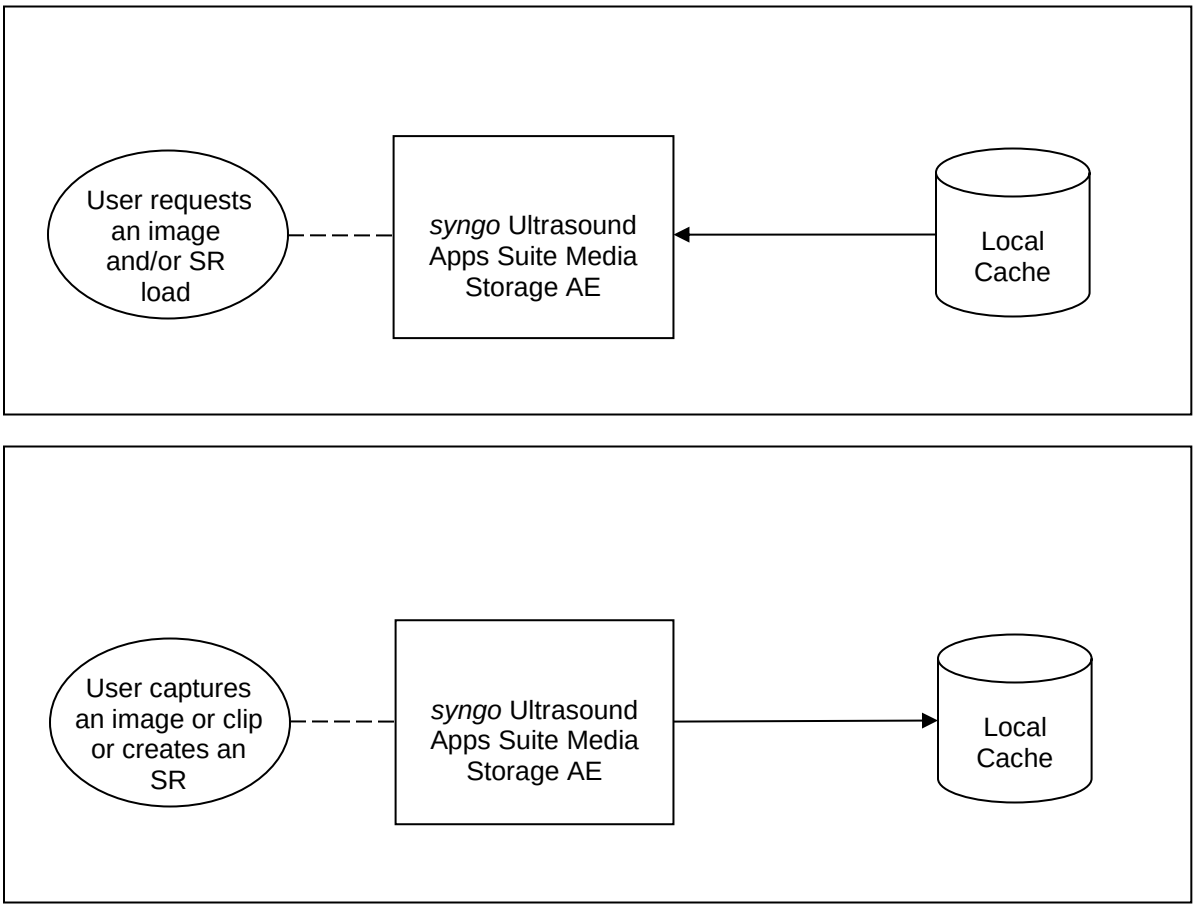

Figure 5-1. *syngo* Ultrasound Apps Suite Application Data Flow Diagram for Media Storage

The *syngo* Ultrasound Apps Suite provides the user interface to read or write DICOM Instances to and from the Local Cache of the local file system as a File Set Reader and File Set Creator. All SOP Classes defined in Table 4-1: SOP Classes for Storage AE are supported for the FSR functionality. For the FSC, Ultrasound Image Storage (Images), Ultrasound Multi-frame Image Storage (Clips), Secondary Capture Image Storage, Comprehensive SR, and Raw Data Storage (Volume images) are supported SOP Classes.

5.1.2 Functional definitions of AEs

The *syngo* Ultrasound Apps Suite is capable of

- reading a user-selected PS3.10 compliant image or SR file from the Local Cache of the local file system

- writing a user-captured image, clip, or SR to the Local Cache of the local file system

5.1.3 Sequencing of Real-World Activities

All FSR and FSC activities are sequentially initiated in the user interface, and another activity may not to be initiated until the prior activity has completed.

5.1.4 File Meta Information for Implementation Class and Version

The implementation information written to the File Meta Header in each file is:

Table 5-1:
Implementation Class/Version Name – Media Interchange

File Meta Information Version	0x0001
Implementation Class UID	1.2.276.0.7230010.3.0.3.5.4
Implementation Version Name	OFFIS_DCMTK_360

Table 5-2:
Implementation Class/Version Name – Media Interchange for Structured Report

File Meta Information Version	0x0001
Implementation Class UID	1.3.12.2.1107.5.8.11
Implementation Version Name	KINETDX

5.2 AE Specifications

5.2.1 Media Storage AE Specification

The *syngo* Ultrasound Apps Suite Media Storage AE provides conformance to the following DICOM SOP Classes as an FSR and/or FSC. The following specifications apply to the AE.

Table 5-3:
Application Profiles, Activities, and Roles for DICOM Exchange Media

Application Profiles Supported	Real World Activity	Role
STD-GEN-FILE	Write a captured image or an SR or Read a captured image or an SR	FSC FSR
STD-US-SC-MF-FILE	Write a captured clip or Read a captured clip	FSC FSR
STD-US-ID-MF-FILE	Load a volume image	FSR

Application Profiles Supported	Real World Activity	Role
	Recaptured a volume image	FSC

5.2.1.1 File Meta Information for Media Storage AE

The Source Application Entity Title included in the File Meta Header is configurable (see section 5.4).

5.2.1.2 Real World Activities

5.2.1.2.1 Activity – Write a captured image, clip, or an SR

The *syngo* Ultrasound Apps Suite Media Storage Application Entity acts as an FSC when a user requests to capture an image or a clip, or write an SR through the user interface. The image or SR files are written in the Local Cache of the local file system.

5.2.1.2.2 Activity – Read a captured image, clip, or an SR

The *syngo* Ultrasound Apps Suite Media Storage Application Entity acts as an FSR when a user selects an image or a clip through the user interface for the image load operation. The image or SR files are read from the Local Cache of the local file system.

5.2.1.2.3 Activity – Load a volume image

The *syngo* Ultrasound Apps Suite Media Storage Application Entity acts as an FSR when a user selects an image or a clip through the user interface for the image load operation. The volume image file is read from the Local Cache of the local file system.

5.2.1.2.4 Activity – Recapture a volume image

The *syngo* Ultrasound Apps Suite Media Storage Application Entity acts as an FSC when a user requests to capture a clip through the user interface. The volume image file is written in the Local Cache of the local file system.

5.3 Media Storage Application Profile

The *syngo* Ultrasound Apps Suite Media Storage Application Entity supports the SOP Classes and Transfer Syntaxes listed in the following sub-sections.

5.3.1 Compliance to STD-GEN-FILE

For media conforming to the STD-GEN-FILE profile. The following SOP Classes will be supported as an FSC and FSR.

Table 5-4:
STD-GEN-FILE Supported SOP Classes

IOD	SOP Class UID	Transfer Syntax and UID	FSC	FSR	FSU
Ultrasound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	Explicit VR Little Endian	Yes	Yes	No
Secondary Capture Image Storage	1.2.840.10008.5.1.4.1.1.7	Explicit VR Little Endian	Yes	No	No
Comprehensive SR	1.2.840.10008.5.1.4.1.1.88.33	Explicit VR Little Endian	Yes	Yes	No

Refer to section 8.1.1.1 US Image IOD Attributes, 8.1.1.3 Secondary Capture Image IOD Attributes, and 8.1.1.4 Comprehensive SR IOD Attributes, for a detailed list of attributes.

5.3.2 Compliance to STD-US-SC-MF-FILE

For media conforming to the STD-US-SC-MF-FILE profiles the following SOP Classes and transfer syntaxes will be supported as an FSC and FSR.

Table 5-5:
STD-US-SC-MF-FILE Supported SOP Classes

IOD	SOP Class UID	Transfer Syntax and UID	FSC	FSR	FSU
Ultrasound Multi-frame Image Storage (Clips)	1.2.840.10008.5.1.4.1.1.3.1	JPEG Lossy (Baseline) 1.2.840.10008.1.2.4.50	Yes	Yes	No

The following Photometric Interpretations are supported by FSC:

- RGB - Ultrasound Image Storage only
- YBR_FULL_422 - Ultrasound Multi-frame Image Storage (Clips) only

Refer to section 8.1.1.2 US Multi-frame Image IOD Attributes, for a detailed list of attributes.

5.3.3 Compliance to STD-US-ID-MF-FILE

For media conforming to the STD-US-ID-MF-FILE profiles the following SOP Classes and transfer syntaxes will be supported as an FSR.

Table 5-6:
STD-US-ID-MF-FILE Supported SOP Classes

IOD	SOP Class UID	Transfer Syntax and UID	FSC	FSR	FSU
Raw Data Storage (Siemens SC2000 volumetric data sets [2])	1.2.840.10008.5.1.4.1.1.66	Implicit VR Little Endian 1.2.840.10008.1.2 Explicit VR Little Endian 1.2.840.10008.1.2.1	Yes	Yes	No

Refer to section 8.1.1.5 Raw Data IOD Attributes, for a detailed list of attributes.

5.4 Media Configuration

The *syngo* Ultrasound Apps Suite uses the client AE Titles configured via the DICOM Configuration Tool for Media Services.

6 SUPPORT OF CHARACTER SETS

6.1 Character Sets for *syngo* Ultrasound Apps Suite

The *syngo* Ultrasound Apps Suite supports the ISO 8859 Latin 1 (ISO-IR 100) character set.

7 SECURITY

7.1 Security Profiles

None supported

7.2 Association Level Security

It is possible to configure whether the DICOM Server will only answer to known AETs or to any AET.

7.3 Application Level Security

- For configuration and maintenance, the Service Technician must login as a Windows administrator with a separate password.

8 ANNEXES

8.1 IOD Contents

8.1.1 Created SOP Instances

The following tables specify the attributes of the Image instance written by *syngo* Ultrasound Apps Suite Media Storage AE.

NOTE: All dates and times are encoded in the local configured calendar and time. Date, Time and Time zone are configured using the Windows Date and Time Properties tool.

8.1.1.1 US Image IOD Attributes

Module	Attribute	Tag	Type	Notes
Patient	Patient's Name	(0010,0010)	2	Copied from existing study
	Patient ID	(0010,0020)	2	Copied from existing study
	Patient's Birth Date	(0010,0030)	2	Copied from existing study
	Patient's Sex	(0010,0040)	2	Copied from existing study
General Study	Study Instance UID	(0020,000D)	1	Copied from existing study
	Study Date	(0008,0020)	2	Copied from existing study
	Study Time	(0008,0030)	2	Copied from existing study
	Referring Physician's Name	(0008,0090)	2	Copied from existing study
	Performing Physician's Name	(0008,1050)	3	Copied from existing study
	Study ID	(0020,0010)	2	Copied from existing study
	Accession Number	(0008,0050)	2	Copied from existing study
	Study Description	(0008,1030)	3	Copied from existing study
Patient Study	Patient's Age	(0010,1010)	3	Copied from existing study
	Patient's Size	(0010,1020)	3	Copied from existing study
	Patient's Weight	(0010,1030)	3	Copied from existing study
General Series	Modality	(0008,0060)	1	Set to "US"
	Series Instance UID	(0020,000E)	1	Copied from existing study
	Series Number	(0020,0011)	2	Copied from existing study
	Series Date	(0008,0021)	3	Copied from existing study
	Series Time	(0008,0031)	3	Copied from existing study
	Series Description	(0008,103E)	3	Copied from existing study
	Protocol Name	(0018,1030)	3	Copied from existing study
	Performed Procedure Step ID	(0040,0253)	3	Copied from existing study
	Performed Procedure Step Start Date	(0040,0244)	3	Copied from existing study
	Performed Procedure Step Start Time	(0040,0245)	3	Copied from existing study
	Performed Procedure Step Description	(0040,0254)	3	Copied from existing study
General Equipment	Manufacturer	(0008,0070)	2	Set to "SIEMENS"
	Station Name	(0008,1010)	3	Set to the *syngo* Ultrasound Apps Suite AE Title
	Manufacturer's Model Name	(0008,1090)	3	Set to "syngo Ultrasound Apps Suite"

Module	Attribute	Tag	Type	Notes
	Device Serial Number	(0018,1000)	3	Generated by device
	Software Versions	(0018,1020)	3	Set to “VA17x” where x is a letter
General Image	Instance Number	(0020,0013)	2	Set to zero length
	Patient Orientation	(0020,0020)	2C	Set to zero length
	Content Date	(0008,0023)	2C	Generated by device
	Content Time	(0008,0033)	2C	Generated by device
	Image Type	(0008,0008)	2	Set to “ORIGINAL\PRIMARY\INTRACARDIAC\0040” if a B mode volume Set to “ORIGINAL\PRIMARY\INTRACARDIAC\0050” if a color volume
	Acquisition Date	(0008,0022)	3	Copied from existing study
	Acquisition Time	(0008,0032)	3	Copied from existing study
	Source Image Sequence	(0008,2112)	3	
	> Referenced SOP Class UID	(0008,1150)	1	1.2.840.10008.5.1.4.1.1.66
	> Referenced SOP Instance UID	(0008,1155)	1	Copied from existing study
Image Pixel	Samples per Pixel	(0028,0002)	1	Set to 3
	Photometric Interpretation	(0028,0004)	1	Set to “RGB”
	Rows	(0028,0010)	1	Set to the height of *syngo* Ultrasound Apps Suite image display area
	Columns	(0028,0011)	1	Set to the width of *syngo* Ultrasound Apps Suite image display area
	Bits Allocated	(0028,0100)	1	Set to 8
	Bits Stored	(0028,0101)	1	Set to 8
	High Bit	(0028,0102)	1	Set to 7
	Pixel Representation	(0028,0103)	1	Set to 0 (unsigned integer)
	Pixel Data	(7FE0,0010)	1	
	Planar Configuration	(0028,0006)	1C	Set to 0 (color-by-pixel)
US Region Calibration	Sequence of Ultrasound Regions	(0018,6011)	1	One created for each US region displayed
	>Region Location Min x0	(0018,6018)	1	
	>Region Location Min y0	(0018,601A)	1	
	>Region Location Max x1	(0018,601C)	1	
	>Region Location Max y1	(0018,601E)	1	
	>Physical Units X Direction	(0018,6024)	1	
	>Physical Units Y Direction	(0018,6026)	1	
	>Physical Delta X	(0018,602C)	1	
	>Physical Delta Y	(0018,602E)	1	
	>Reference Pixel x0	(0018,6020)	3	
	>Reference Pixel y0	(0018,6022)	3	
	>Ref. Pixel Physical Value X	(0018,6028)	3	
	>Ref. Pixel Physical Value Y	(0018,602A)	3	

Module	Attribute	Tag	Type	Notes
	>Region Spatial Format	(0018,6012)	1	
	>Region Data Type	(0018,6014)	1	
	>Region Flags	(0018,6016)	1	
US Image	Number of Stages	(0008,2124)	2C	Copied from existing study
	Number of Views in Stage	(0008,212A)	2C	Copied from existing study
	Heart Rate	(0018,1088)	3	
	Transducer Data	(0018,5010)	3	Probe name, copied from existing study
	Transducer Type	(0018,6031)	3	Copied from existing study
	Focus Depth	(0018,5012)	3	Copied from existing study
	Mechanical Index	(0018,5022)	3	Copied from existing study
SOP Common	SOP Class UID	(0008,0016)	1	1.2.840.10008.5.1.4.1.1.6.1
	SOP Instance UID	(0008,0018)	1	Generated by device
	Specific Character Set	(0008,0005)	1C	ISO_IR 100
	Instance Creation Date	(0008,0012)	3	Generated by device
	Instance Creation Time	(0008,0013)	3	Generated by device

8.1.1.2 US Multi-frame Image IOD Attributes

Module	Attribute	Tag	Type	Notes
Patient	Patient's Name	(0010,0010)	2	Copied from existing study
	Patient ID	(0010,0020)	2	Copied from existing study
	Patient's Birth Date	(0010,0030)	2	Copied from existing study
	Patient's Sex	(0010,0040)	2	Copied from existing study
General Study	Study Instance UID	(0020,000D)	1	Copied from existing study
	Study Date	(0008,0020)	2	Copied from existing study
	Study Time	(0008,0030)	2	Copied from existing study
	Referring Physician's Name	(0008,0090)	2	Copied from existing study
	Performing Physician’s Name	(0008,1050)	3	Copied from existing study
	Study ID	(0020,0010)	2	Copied from existing study
	Accession Number	(0008,0050)	2	Copied from existing study
	Study Description	(0008,1030)	3	Copied from existing study
Patient Study	Patient's Age	(0010,1010)	3	Copied from existing study
	Patient's Size	(0010,1020)	3	Copied from existing study
	Patient's Weight	(0010,1030)	3	Copied from existing study
General Series	Modality	(0008,0060)	1	Set to “US”
	Series Instance UID	(0020,000E)	1	Copied from existing study
	Series Number	(0020,0011)	2	Copied from existing study
	Series Date	(0008,0021)	3	Copied from existing study
	Series Time	(0008,0031)	3	Copied from existing study
	Series Description	(0008,103E)	3	Copied from existing study
	Protocol Name	(0018,1030)	3	Copied from existing study
	Performed Procedure Step ID	(0040,0253)	3	Copied from existing study

Module	Attribute	Tag	Type	Notes
	Performed Procedure Step Start Date	(0040,0244)	3	Copied from existing study
	Performed Procedure Step Start Time	(0040,0245)	3	Copied from existing study
	Performed Procedure Step Description	(0040,0254)	3	Copied from existing study
General Equipment	Manufacturer	(0008,0070)	2	Set to “SIEMENS”
	Station Name	(0008,1010)	3	Set to the *syngo* Ultrasound Apps Suite AE Title
	Manufacturer's Model Name	(0008,1090)	3	Set to “syngo Ultrasound Apps Suite”
	Device Serial Number	(0018,1000)	3	Generated by device
	Software Versions	(0018,1020)	3	Set to “VA17x” where x is a letter
General Image	Instance Number	(0020,0013)	2	Set to zero length
	Patient Orientation	(0020,0020)	2C	Set to zero length
	Content Date	(0008,0023)	2C	Generated by device
	Content Time	(0008,0033)	2C	Generated by device
	Image Type	(0008,0008)	2	Set to “ORIGINAL\PRIMARY\INTRACARDIAC\0040” if a B mode volume Set to “ORIGINAL\PRIMARY\INTRACARDIAC\0050” if a color volume
	Acquisition Date	(0008,0022)	3	Copied from existing study
	Acquisition Time	(0008,0032)	3	Copied from existing study
	Source Image Sequence	(0008,2112)	3	
	> Referenced SOP Class UID	(0008,1150)	1	1.2.840.10008.5.1.4.1.1.66
	> Referenced SOP Instance UID	(0008,1155)	1	Copied from existing study
	Burned In Annotation	(0028,0301)	3	“No” if no patient data overlaid on the image. “Yes” if the patient data overlaid on the image.
	Lossy Image Compression	(0028,2110)	3	Set to 01
	Lossy Image Compression Ratio	(0028,2112)	3	
	Lossy Image Compression Method	(0028,2114)	3	Set to “ISO_10918_1\RGB_TO_YBR”
Image Pixel	Samples per Pixel	(0028,0002)	1	Set to 3
	Photometric Interpretation	(0028,0004)	1	Set to “YBR_FULL_422”
	Rows	(0028,0010)	1	Set to the height of *syngo* Ultrasound Apps Suite image display area
	Columns	(0028,0011)	1	Set to the width of *syngo* Ultrasound Apps Suite image display area
	Bits Allocated	(0028,0100)	1	Set to 8
	Bits Stored	(0028,0101)	1	Set to 8
	High Bit	(0028,0102)	1	Set to 7
	Pixel Representation	(0028,0103)	1	Set to 0 (unsigned integer)

Module	Attribute	Tag	Type	Notes
	Pixel Data	(7FE0,0010)	1	
	Planar Configuration	(0028,0006)	1C	Set to 0 (color-by-pixel)
Cine	Frame Time	(0018,1063)	1C	
	Frame Time Vector	(0018,1065)	1C	
Multi-Frame	Number of Frames	(0028,0008)	1	1 to Number of Frames
	Frame Increment Pointer	(0028,0009)	1C	Sequencing by Frame Time Vector (0018,1065)
US Region Calibration	Sequence of Ultrasound Regions	(0018,6011)	1	One created for each US region displayed
	>Region Location Min x0	(0018,6018)	1	
	>Region Location Min y0	(0018,601A)	1	
	>Region Location Max x1	(0018,601C)	1	
	>Region Location Max y1	(0018,601E)	1	
	>Physical Units X Direction	(0018,6024)	1	
	>Physical Units Y Direction	(0018,6026)	1	
	>Physical Delta X	(0018,602C)	1	
	>Physical Delta Y	(0018,602E)	1	
	>Reference Pixel x0	(0018,6020)	3	
	>Reference Pixel y0	(0018,6022)	3	
	>Ref. Pixel Physical Value X	(0018,6028)	3	
	>Ref. Pixel Physical Value Y	(0018,602A)	3	
	>Region Spatial Format	(0018,6012)	1	
	>Region Data Type	(0018,6014)	1	
	>Region Flags	(0018,6016)	1	
US Image	Number of Stages	(0008,2124)	2C	Copied from existing study
	Number of Views in Stage	(0008,212A)	2C	Copied from existing study
	R Wave Time Vector	(0018,6060)	3	Copied from existing study
	Heart Rate	(0018,1088)	3	
	Transducer Data	(0018,5010)	3	Probe name, copied from existing study
	Transducer Type	(0018,6031)	3	Copied from existing study
	Focus Depth	(0018,5012)	3	Copied from existing study
	Mechanical Index	(0018,5022)	3	Copied from existing study
	RWaveTimeVector	(0018,6060)	3	Vector of time offsets of the r-wave peaks relative to the start of Acquisition Datetime of the image data.
SOP Common	SOP Class UID	(0008,0016)	1	1.2.840.10008.5.1.4.1.1.3.1
	SOP Instance UID	(0008,0018)	1	Generated by device
	Specific Character Set	(0008,0005)	1C	ISO_IR 100
	Instance Creation Date	(0008,0012)	3	Generated by device
	Instance Creation Time	(0008,0013)	3	Generated by device
Standard Extended SOP Class - Standard and Private Attributes				
Waveform	Waveform Sequence	(5400,0100)	1	
	>Acquisition Datetime	(0008,002A)	1	
	>Trigger Time Offset	(0018,1069)	1C	

Module	Attribute	Tag	Type	Notes
	>Waveform Originality	(003A,0004)	1	ORIGINAL
	>Number of Waveform Channels	(003A,0005)	1	1
	>Number of Waveform Samples	(003A,0010)	1	
	>Sampling Frequency	(003A,001A)	1	
	>Channel Definition Sequence	(003A,0200)	1	
	>>Channel Source Sequence	(003A,0208)	1	
	>>>Include 'Code Sequence Macro'			
	>>Channel Sensitivity	(003A,0210)	1C	
	>>Channel Sensitivity Units Sequence	(003A,0211)	1C	
	>>>Include 'Code Sequence Macro'			
	>>Waveform Bits Stored	(003A,021A)	1	
	>Waveform Bits Allocated	(5400,1004)	1	
	>Waveform Sample Interpretation	(5400,1006)	1	
	>Waveform Data	(5400,1010)	1	
Private	Private Creator Data Element (Implementor)	(0119,0010)	1	Set to "SIEMENS Ultrasound SC2000"
	Volume Rate	(0119,1013)	3	

8.1.1.3 Secondary Capture Image IOD Attributes

Module	Attribute	Tag	Type	Notes
Patient	Patient's Name	(0010,0010)	2	Copied from existing study
	Patient ID	(0010,0020)	2	Copied from existing study
	Patient's Birth Date	(0010,0030)	2	Copied from existing study
	Patient's Sex	(0010,0040)	2	Copied from existing study
General Study	Study Instance UID	(0020,000D)	1	Copied from existing study
	Study Date	(0008,0020)	2	Copied from existing study
	Study Time	(0008,0030)	2	Copied from existing study
	Referring Physician's Name	(0008,0090)	2	Copied from existing study
	Performing Physician's Name	(0008,1050)	3	Copied from existing study
	Study ID	(0020,0010)	2	Copied from existing study
	Accession Number	(0008,0050)	2	Copied from existing study
	Study Description	(0008,1030)	3	Copied from existing study
Patient Study	Patient's Age	(0010,1010)	3	Copied from existing study
	Patient's Size	(0010,1020)	3	Copied from existing study
	Patient's Weight	(0010,1030)	3	Copied from existing study
General Series	Modality	(0008,0060)	1	Copied from existing study
	Series Instance UID	(0020,000E)	1	Copied from existing study
	Series Number	(0020,0011)	2	Copied from existing study
	Series Date	(0008,0021)	3	Copied from existing study
	Series Time	(0008,0031)	3	Copied from existing study
	Series Description	(0008,103E)	3	Copied from existing study

Module	Attribute	Tag	Type	Notes
	Protocol Name	(0018,1030)	3	Copied from existing study
	Performed Procedure Step ID	(0040,0253)	3	Copied from existing study
	Performed Procedure Step Start Date	(0040,0244)	3	Copied from existing study
	Performed Procedure Step Start Time	(0040,0245)	3	Copied from existing study
	Performed Procedure Step Description	(0040,0254)	3	Copied from existing study
General Equipment	Manufacturer	(0008,0070)	2	Set to “SIEMENS”
	Station Name	(0008,1010)	3	Set to the *syngo* Ultrasound Apps Suite AE Title
	Manufacturer's Model Name	(0008,1090)	3	Set to “syngo Ultrasound Apps Suite”
	Device Serial Number	(0018,1000)	3	Generated by device
	Software Versions	(0018,1020)	3	Set to *syngo* Ultrasound Apps Suite Software Version
SC Equipment	Conversion Type	(0008,0064)	1	Set to WSD
General Image	Instance Number	(0020,0013)	2	Set to zero length
	Patient Orientation	(0020,0020)	2C	Set to zero length
	Content Date	(0008,0023)	2C	Generated by device
	Content Time	(0008,0033)	2C	Generated by device
	Image Type	(0008,0008)	2	DERIVED\SECONDARY\INTRACARDIAC\0040 if a B-mode volume DERIVED\SECONDARY\INTRACARDIAC\0050 if a volume with Color Doppler
	Acquisition Date	(0008,0022)	3	Copied from existing study
	Acquisition Time	(0008,0032)	3	Copied from existing study
	Source Image Sequence	(0008,2112)	3	For LVA, there are two sequence items: 1. one reference to a source volume image 2. one reference to a bookmark object Otherwise, this attribute is not present.
	>Referenced SOP Class UID	(0008,1150)	1	1.2.840.10008.5.1.4.1.1.66
	>Referenced SOP Instance UID	(0008,1155)	1	SOP Instance UID of source image or SOP Instance UID of bookmark
	Burned in Annotation	(0028,0301)	3	NO if no patient data is overlaid on the image. YES if the patient data is overlaid on the image.
Image Pixel	Samples Per Pixel	(0028,0002)	1	Set to 3
	Photometric Interpretation	(0028,0004)	1	RGB
	Rows	(0028,0010)	1	Height of *syngo* Ultrasound Apps Suite image area in pixels
	Columns	(0028,0011)	1	Width of *syngo* Ultrasound Apps Suite image are in pixels
	Bits Allocated	(0028,0100)	1	Set to 8
	Bits Stored	(0028,0101)	1	Set to 8
	High Bit	(0028,0102)	1	Set to 7
	Pixel Representation	(0028,0103)	1	Set to 0 (unsigned integer)

Module	Attribute	Tag	Type	Notes
	Pixel Data	(7FE0,0010)	1	
	Planar Configuration	(0028,0006)	1C	Set to 0 (color-by-pixel)
SOP Common	SOP Class UID	(0008,0016)	1	1.2.840.10008.5.1.4.1.1.7
	SOP Instance UID	(0008,0018)	1	Generated by device
	Specific Character Set	(0008,0005)	1C	ISO_IR 100
	Instance Creation Date	(0008,0012)	3	Generated by device
	Instance Creation Time	(0008,0013)	3	Generated by device

8.1.1.4 Comprehensive SR IOD Attributes

Module Name	Attribute	Tag	Type	Notes
Patient	Patient's Name	(0010,0010)	2	Copied from existing study
	Patient ID	(0010,0020)	2	Copied from existing study
	Patient's Birth Date	(0010,0030)	2	Copied from existing study
	Patient's Sex	(0010,0040)	2	Copied from existing study
General Study	Study Instance UID	(0020,000D)	1	Copied from existing study
	Study Date	(0008,0020)	2	Copied from existing study
	Study Time	(0008,0030)	2	Copied from existing study
	Referring Physician's Name	(0008,0090)	2	Copied from existing study
	Performing Physician's Name	(0008,1050)	3	Copied from existing study
	Study ID	(0020,0010)	2	Copied from existing study
	Accession Number	(0008,0050)	2	Copied from existing study
	Study Description	(0008,1030)	3	Copied from existing study
Patient Study	Patient's Age	(0010,1010)	3	Copied from existing study
	Patient's Size	(0010,1020)	3	Copied from existing study
	Patient's Weight	(0010,1030)	3	Copied from existing study
General Equipment	Manufacturer	(0008,0070)	2	Set to "SIEMENS"
	Station Name	(0008,1010)	3	Set to the *syngo* Ultrasound Apps Suite AE Title
	Manufacturer's Model Name	(0008,1090)	3	Set to "Siemens Ultrasound"
	Device Serial Number	(0018,1000)	3	Generated by device
	Software Versions	(0018,1020)	3	Set to "SRMap1.0"
SR Document Series	Modality	(0008,0060)	1	Defined term "SR" used
	Series Instance UID	(0020,000E)	1	Uniquely generated by *syngo* Ultrasound Apps Suite
	Series Number	(0020,0011)	1	Set to zero
	Series Date	(0008,0021)	3	Generated by device
	Series Time	(0008,0031)	3	Generated by device
	Series Description	(0008,103E)	3	Clinical Application Package name
	Referenced Performed Procedure Step Sequence	(0008,1111)	2	Empty sequence
SR Document General	Instance Number	(0020,0013)	1	Set to zero
	Completion Flag	(0040,A491)	1	Defined Term "PARTIAL" used
	Verification Flag	(0040,A493)	1	Defined Term "UNVERIFIED" used

Module Name	Attribute	Tag	Type	Notes
	Content Date	(0008,0023)	1	Generated by device
	Content Time	(0008,0033)	1	Generated by device
	Referenced Request Sequence	(0040,A370)	1C	Copied from existing study
	>Study Instance UID	(0020,000D)	1	Copied from existing study
	>Referenced Study Sequence	(0008,1110)	2	Copied from existing study
	>>Referenced SOP Class UID	(0008,1150)	1	Copied from existing study
	>>Referenced SOP Instance UID	(0008,1155)	1	Copied from existing study
	>Accession Number	(0008,0050)	2	Copied from existing study
	>Placer Order Number/Imaging Service Request	(0040,2016)	2	Copied from existing study
	>Filler Order Number/Imaging Service Request	(0040,2017)	2	Copied from existing study
	>Requested Procedure ID	(0040,1001)	2	Copied from existing study
	>Requested Procedure Description	(0032,1060)	2	Copied from existing study
	>Requested Procedure Code Sequence	(0032,1064)	2	Copied from existing study
	>>Include 'Code Sequence Macro'			
	Performed Procedure Code Sequence	(0040,A372)	2	Empty sequence
	>Include 'Code Sequence Macro'			
SR Document Content	Value Type	(0040,A040)	1	CONTAINER
	Concept Name Code Sequence	(0040,A043)	1C	
	>Code Value	(0008,0100)	1	Set to "125200" for Adult Echocardiography Procedure Report
	>Coding Scheme Designator	(0008,0102)	1	Set to "DCM"
	>Code Meaning	(0008,0104)	1	Set to "Adult Echocardiography Procedure Report"
	Continuity of Content	(0040,A050)	1	SEPARATE
	Content Template Sequence	(0040,A504)	1C	
	>Mapping Resource	(0008,0105)	1	Set to "DCMR"
	>Template Identifier	(0040,DB00)	1	Set to "5200" for Adult Echocardiography Procedure Report
	Content Sequence	(0040,A730)	1C	See Appendix for content of "Adult Echocardiography Procedure Report"
SOP Common	SOP Class UID	(0008,0016)	1	1.2.840.10008.5.1.4.1.1.88.33
	SOP Instance UID	(0008,0018)	1	Generated by device
	Specific Character Set	(0008,0005)	1C	Set to ISO_IR 100
	Instance Creation Date	(0008,0012)	3	Generated by device
	Instance Creation Time	(0008,0013)	3	Generated by device

8.1.1.5 Raw Data IOD Attributes

Module	Attribute	Tag	Type	Notes
Patient	Patient's Name	(0010,0010)	2	Copied from existing study
	Patient ID	(0010,0020)	2	Copied from existing study

Module	Attribute	Tag	Type	Notes
	Patient's Birth Date	(0010,0030)	2	Copied from existing study
	Patient's Sex	(0010,0040)	2	Copied from existing study
General Study	Study Instance UID	(0020,000D)	1	Copied from existing study
	Study Date	(0008,0020)	2	Copied from existing study
	Study Time	(0008,0030)	2	Copied from existing study
	Referring Physician's Name	(0008,0090)	2	Copied from existing study
	Performing Physician's Name	(0008,1050)	3	Copied from existing study
	Study ID	(0020,0010)	2	Copied from existing study
	Accession Number	(0008,0050)	2	Copied from existing study
	Study Description	(0008,1030)	3	Copied from existing study
Patient Study	Patient's Age	(0010,1010)	3	Copied from existing study
	Patient's Size	(0010,1020)	3	Copied from existing study
	Patient's Weight	(0010,1030)	3	Copied from existing study
General Series	Modality	(0008,0060)	1	Copied from existing study
	Series Instance UID	(0020,000E)	1	Copied from existing study
	Series Number	(0020,0011)	2	Copied from existing study
	Series Date	(0008,0021)	3	Copied from existing study
	Series Time	(0008,0031)	3	Copied from existing study
	Series Description	(0008,103E)	3	Copied from existing study
	Protocol Name	(0018,1030)	3	Copied from existing study
	Performed Procedure Step ID	(0040,0253)	3	Copied from existing study
	Performed Procedure Step Start Date	(0040,0244)	3	Copied from existing study
	Performed Procedure Step Start Time	(0040,0245)	3	Copied from existing study
	Performed Procedure Step Description	(0040,0254)	3	Copied from existing study
General Equipment	Manufacturer	(0008,0070)	2	Set to "SIEMENS"
	Station Name	(0008,1010)	3	*syngo* Ultrasound Apps Suite AE title
	Manufacturer's Model Name	(0008,1090)	3	Set to "syngo Ultrasound Apps Suite"
	Device Serial Number	(0018,1000)	3	Generated by device
	Software Versions	(0018,1020)	3	Set to "VA17x" where x is a letter
Acquisition Context	Acquisition Context Sequence	(0040,0555)	2	Zero length
Raw Data	Instance Number	(0020,0013)	2	Set to zero.
	Content Date	(0008, 0023)	1	Date when creation of this object started
	Content Time	(0008, 0033)	1	Time when creation of this object started
	Acquisition Date	(0008,0022)	3	Copied from existing study
	Acquisition Time	(0008,0032)	3	Copied from existing study
	Acquisition DateTime	(0008,002A)	3	Combined values of Acquisition Date and Acquisition Time

Module	Attribute	Tag	Type	Notes
Raw Data	Creator-Version UID	(0008,9123)	1	Unique identification for the equipment and version of the software that has created this object
	Source Image Sequence	(0008,2112)	1C	Image object that was used to derive this object. Required if Acoustic Data Sequence (0019,1002) is not present.
	>Referenced SOP Class UID	(0008,1150)	1	SOP Class UID for Raw Data IOD
	>Referenced SOP Instance UID	(0008,1155)	1	SOP Instance UI of the Raw Data object that was used to derive this object
	Referenced Image Sequence	(0008,1140)	3	Reference to the 2D Image representing this view
	>Referenced SOP Class UID	(0008,1150)	1	SOP Class UID for the DICOM Ultrasound Image Storage SOP Class or the DICOM Ultrasound Multi-Frame Image Storage SOP Class
	>Referenced SOP Instance UID	(0008,1155)	1	SOP Instance UI of the referenced image
	Private Creator Data Element (Implementor)	(0119,0010)	1	SIEMENS Ultrasound SC2000
	Multi Stream Sequence	(0119,1002)	1C	Sequence of acoustic data blocks for multiple streams. One sequence per stream. Required if source image sequence is not present.
	> Private Creator Data Element	(0119,0010)	1	SIEMENS Ultrasound SC2000
	>Acoustic Data Sequence	(0119,1003)	1C	Sequence for chunks of acoustic data for specific control information and acoustic data chunks. One item per chunk. One sequence per transaction.
	>>Private Creator Data Element	(0119,0010)	1C	SIEMENS Ultrasound SC2000
	>>Per Transaction Acoustic Control Information	(0119,1004)	1C	Transaction data, one for each transaction
	>>Acoustic Data Offset	(0119,1005)	1C	Offset of current Volume in Acoustic Image and Footer Data. One per transaction per stream
	>>Acoustic Data Length	(0119,1006)	1C	Length of current Volume in Acoustic Image and Footer Data One per transaction per stream
	>>Footer Offset	(0119,1007)	1C	Offset of footer for current Volume in Acoustic Image and Footer Data One per transaction per stream
	>>Footer Length	(0119,1008)	1C	Length of footer for current Volume in Acoustic Image and Footer Data One per transaction per stream
	>Acoustic Stream Number	(0119, 1009)	1C	Identification of acoustic stream number. One per stream

Module	Attribute	Tag	Type	Notes
	>Acoustic Stream Type	(0119,1010)	1C	Identification of acoustic stream type. One per stream
	Volume Rate	(0119,1013)	3	Volumes per second
	Volume DataSet Version	(0119,1021)	3	Version of the volume dataset
	Private Creator Data Element (Implementor)	(0129,0010)	1	SIEMENS Ultrasound SC2000
	Visualization Sequence	(0129,1006)	3	Sequence for Volume Rendered views. One item for each view.
	>Private Creator Data Element	(0129,0010)	1	SIEMENS Ultrasound SC2000
	>Visualization Information	(0129,1008)	1C	Volume rendering parameters. Required if Sequence is present.
	Application State Sequence	(0129,1009)	3	Sequence of application states. One item for each application that was started online
	>Private Creator Data Element	(0129,0010)	1	SIEMENS Ultrasound SC2000
	>Application State Information	(0129,1010)	1C	Application state information.
	Cine Parameters	(0129,1020)	3	
	>Private Creator Data Element	(0129,0010)	3	SIEMENS Ultrasound SC2000
	>Cine Parameters Schema	(0129,1021)	3	Schema describing stored Cine Parameters Data
	>Cine Parameters Data	(0129,1022)	3	Values of Cine Parameters
	Cine Parameters Dump	(0129,1029)	3	
	Raw Data Object Type	(0129,1030)	1	Defined Term for Object Type • VOLUME • APPLICATION STATE • EXAM STATE • ORIENTATION STATE • APP STATE
	Application Name	(0129,1031)	1C	CAP Name
	Private Creator Data Element	(7FD1,0010)	1	
	Acoustic Data Version UID	(7FD1,1009)	1	
	Acoustic Image and Footer Data	(7FD1,1010)	1	
	Private Creator Data Element	(0149,0010)	1	SIEMENS Ultrasound SC2000
	Acoustic Rotation Angle	(0149,1004)	3	
US Image	Transducer Data	(0018,5010)	3	Copied from existing study
	Transducer Type	(0018,6031)	3	Copied from existing study
	Focus Depth	(0018,5012)	3	Copied from existing study
	Heart Rate	(0018,1088)	3	Beats per minute
	Mechanical Index	(0018,5022)	3	The mechanical index, when made available by a manufacturer, is defined according to the *Standard for Real-Time Display of Thermal and Mechanical Acoustic Output Indices on Diagnostic Ultrasound Equipment*
	RWaveTimeVector	(0018,6060)	3	

Module	Attribute	Tag	Type	Notes
Waveform	Waveform Sequence	(5400,0100)	1	Representation of the waveform, one item per waveform type
	>Acquisition DateTime	(0008,002A)	1	Date and Time when the acquisition resulting in this waveform data started
	>Trigger Time Offset	(0018,1069)	1C	Offset time in milliseconds from Acquisition Datetime of image data
	>Waveform Originality	(003A,0004)	1	ORIGINAL
	>Number of Waveform Channels	(003A,0005)	1	Set to 1
	>Number of Waveform Samples	(003A,0010)	1	Number of samples per channel
	>Sampling Frequency	(003A,001A)	1	Frequency in Hz shall be between 200 and 1000 for ECG waveforms and less than or equat to 20 for respiratory waveforms.
	>Channel Definition Sequence	(003A,0200)	1	One item per channel. Ordering of items is significant for reference of specific channels.
	>>Channel Source Sequence	(003A,0208)	1	Code descriptor of waveform, one item only
	>>>Include 'Code Sequence Macro'			
	>>Channel Sensitivity	(003A,0210)	1C	Unit quantity of sample. Required if samples represent defined units.
	>>Channel Sensitivity Units Sequence	(003A,0211)	1C	Units of measure for the channel sensitivity. Required if Channel Sensitivity is present.
	>>>Include 'Code Sequence Macro'			
	>>Waveform Bits Stored	(003A,021A)	1	Number of significant bits within the waveform sample.
	>Waveform Bits Allocated	(5400,1004)	1	Set to 16
	>Waveform Sample Interpretation	(5400,1006)	1	Set to 16
	>Waveform Data	(5400,1010)	1	Encoded data samples
SOP Common	SOP Class UID	(0008,0016)	1	1.2.840.10008.5.1.4.1.1.66
	SOP Instance UID	(0008,0018)	1	Created
	Specific Character Set	(0008,0005)	1C	ISO_IR 100
	Instance Creation Date	(0008,0012)	3	Created
	Instance Creation Time	(0008,0013)	3	Created

8.1.1.6 Query: C-Find

The *syngo* Ultrasound Apps Suite DICOM Query/Retrieve SCU supports hierarchical queries with all mandatory search keys. The interactive querying of attributes is not supported by the *syngo* Ultrasound Apps Suite. Though, retrieval of individual Objects is possible. The following table describes the search keys for the different query models that the SCU supports. Matching is either wildcard, which means that the user can supply a string containing wildcards, or universal, which means that the attribute is requested as return value.

Attribute Name	Tag	Type	Matching	User Input	Return Value Display
Study Level					
Study Instance UID	(0020,000D)	U	Single value	N/A	No
Patient Name	(0010,0010)	R	Universal (Null)	N/A	No
Patient ID	(0010,0020)	R	Universal (Null)	N/A	No
Study ID	(0020,0010)	R	Universal (Null)	N/A	No
Study Date	(0008,0020)	R	Universal (Null)	N/A	No
Study Time	(0008,0030)	R	Universal (Null)	N/A	No
Accession Number	(0008,0050)	R	Universal (Null)	N/A	No
Study Description	(0008,1030)	O	Universal (Null)	N/A	No
Referring Physician's Name	(0008,0090)	O	Universal (Null)	N/A	No
Modalities in Study	(0008,0061)	O	Universal (Null)	N/A	No
SOP Classes in Study	(0008,0062)	O	Universal (Null)	N/A	No
Retrieve AE Title	(0008,0054)	O	Universal (Null)	N/A	No
Series Level					
Series Instance UID	(0020,000E)	U	Single value	N/A	No
Series Number	(0020,0011)	R	Universal (Null)	N/A	No
Modality	(0008,0060)	R	Universal (Null)	N/A	No
Series Description	(0008,103E)	O	Universal (Null)	N/A	No
Number of Series related Instances	(0020,1209)	O	Universal (Null)	N/A	No
Retrieve AE Title	(0008,0054)	O	Universal (Null)	N/A	No
Image Level					
SOP Instance UID	(0008,0018)	U	Single value	N/A	No
Image Number	(0020,0013)	R	Universal (Null)	N/A	No
SOP Class UID	(0008,0016)	O	Universal (Null)	N/A	No
Retrieve AE Title	(0008,0054)	O	Universal (Null)	N/A	No

9 APPENDICES

9.1 Appendix A: Echocardiography Structured Report

This appendix lists the DICOM Structured Report (SR) mappings used in the Cardiac Structured Reports of the *syngo* Ultrasound Apps Suite SR files.

The mappings follow the DICOM SR Template TID 5200: Echocardiography Procedure Report, as described in PS 3.16-2011 of the DICOM Standard, and are organized in a manner similar to TID 5200. The **Label** column identifies the on-screen measurement name. All private code values use the Coding Scheme Designator "99SIEMENS".

The **Mean** column indicates if a measurement has an average value associated it when multiple instances of a Clinical Application Package result are present in the SR from executing a CAP multiple times. A mean value is defined in the SR by a measurement having the following modifier:

Rel with Parent	VT	Concept Name	VM	Concept Value
HAS CONCEPT MOD	CODE	Derivation (DCM, 121401)	1	Mean (SRT, R-00317)

Private sections that contain the results of Clinical Application Packages are defined as Findings CONTAINERs with the modifier

Rel with Parent	VT	Concept Name	VM	Concept Value
HAS CONCEPT MOD	CODE	Clinical Application Package (99SIEMENS, CAP)	1	See section 9.1.8

9.1.1 Patient Characteristics

Label	Code Meaning (Coding Scheme Designator, Code Value)	Modifiers
Patient Characteristics	Container: Patient Characteristics (DCM, 121118)	
[Not shown]	Body Surface Area (LN, 8277-6)	Body Surface Area Formula: BSA = 0.007184*WT^0.425*HT^0.725 (DCM, 122241)
[Not shown]	Diastolic Blood Pressure (SRT, F-008ED)	

[Not shown]	Subject Age (DCM, 121033)	
[Not shown]	Subject Sex (DCM, 121032)	
[Not shown]	Systolic Blood Pressure (SRT, F-008EC)	

9.1.2 Left Ventricle

Mean	Label	Code Meaning (Coding Scheme Designator, Code Value)	Modifiers
Left Ventricle		Container: Findings (DCM, 121070)	Finding Site: Left Ventricle (SRT, T-32600)
Measurements of Image Mode: 2D mode (SRT, G-03A2)			
	[Not shown]	Cardiovascular Orifice Diameter (SRT, G-038F)	Finding Site: Left Ventricle Outflow Tract (SRT, T-32650) Cardiac Cycle Point: Systole (SRT, F-32020)
Measurements are associated with CW and PW, so the image mode is not specified			
	[Not shown]	Velocity Time Integral (LN, 20354-7)	Finding Site: Left Ventricle Outflow Tract (SRT, T-32650)

9.1.3 Right Ventricle

Mean	Label	Code Meaning (Coding Scheme Designator, Code Value)	Modifiers
Right Ventricle		Container: Findings (DCM, 121070)	Finding Site: Right Ventricle (SRT, T-32500)
Measurements of Image Mode: 2D mode (SRT, G-03A2)			
	[Not shown]	Cardiovascular Orifice Diameter (SRT, G-038F)	Finding Site: Right Ventricle Outflow Tract (SRT, T-32550) Cardiac Cycle Point: Systole (SRT, F-32020)

9.1.4 Aortic Valve

Mean	Label	Code Meaning (Coding Scheme Designator, Code Value)	Modifiers
Aortic Valve		Container: Findings (DCM, 121070)	Finding Site: Aortic Valve (SRT, T-35400)
Measurements are associated with CW and PW, so the image mode is not specified			
	[Not shown]	Peak Velocity (LN, 11726-7)	Flow Direction: Regurgitant Flow (SRT, R-42E61)
	[Not shown]	Velocity Time Integral (LN, 20354-7)	Flow Direction: Regurgitant Flow (SRT, R-42E61)

9.1.5 Mitral Valve

Mean	Label	Code Meaning (Coding Scheme Designator, Code Value)	Modifiers
Mitral Valve		Container: Findings (DCM, 121070)	Finding Site: Mitral Valve (SRT, T-35300)
Measurements of Image Mode: 2D mode (SRT, G-03A2)			
	[Not shown]	Cardiovascular Orifice Diameter (SRT, G-038F)	Image View: Parasternal long axis (SRT, G-0396)
	[Not shown]	Cardiovascular Orifice Diameter (SRT, G-038F)	Image View: Apical four chamber (SRT, G-A19C)
Measurements are associated with CW and PW, so the image mode is not specified			
	[Not shown]	Peak Velocity (LN, 11726-7)	Flow Direction: Regurgitant Flow (SRT, R-42E61)
	[Not shown]	Velocity Time Integral (LN, 20354-7)	Flow Direction: Regurgitant Flow (SRT, R-42E61)
	[Not shown]	Velocity Time Integral (LN, 20354-7)	Finding Site: Mitral Annulus (SRT, T-35313)

9.1.6 Pulmonic Valve

Mean	Label	Code Meaning (Coding Scheme Designator, Code Value)	Modifiers
Pulmonic Valve		Container: Findings (DCM, 121070)	Finding Site: Pulmonic Valve (SRT, T-35200)
Measurements are associated with CW and PW, so the image mode is not specified			
	[Not shown]	Peak Velocity (LN, 11726-7)	Flow Direction: Regurgitant Flow (SRT, R-42E61)
	[Not shown]	Velocity Time Integral (LN, 20354-7)	Flow Direction: Regurgitant Flow (SRT, R-42E61)
	[Not shown]	Velocity Time Integral (LN, 20354-7)	

9.1.7 Tricuspid Valve

Mean	Label	Code Meaning (Coding Scheme Designator, Code Value)	Modifiers
Tricuspid Valve		Container: Findings (DCM, 121070)	Finding Site: Tricuspid Valve (SRT, T-35100)
Measurements of Image Mode: 2D mode (SRT, G-03A2)			
	[Not shown]	Cardiovascular Orifice Diameter (SRT, G-038F)	Finding Site: Tricuspid Annulus (SRT, T-35111) Cardiac Cycle Point: Diastole (SRT, F-32010) Image View: Apical four chamber (SRT, G-A19C)
Measurements are associated with CW and PW, so the image mode is not specified			
	[Not shown]	Peak Velocity (LN, 11726-7)	Flow Direction: Regurgitant Flow (SRT, R-42E61)
	[Not shown]	Velocity Time Integral (LN, 20354-7)	Flow Direction: Regurgitant Flow (SRT, R-42E61)
	[Not shown]	Velocity Time Integral (LN, 20354-7)	Finding Site: Leaflet Tips (99SIEMENS, LeafletTips)

9.1.8 Private Section: Clinical Application Package

Results from Clinical Application Packages are in private sections defined as Findings CONTAINERs with the modifier HAS CONCEPT MOD, CODE, Clinical Application Package (99SIEMENS, CAP) with VM of 1.

The SR measurements for each CAP are defined in the following sections.

The general Clinical Application Package (CAP) SR structure is defined below.

TID 5200 Extension

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
22	>	CONTAINS	INCLUDE	Private TID: Clinical Application Package	1-n	U		

Private TID: Clinical Application Package

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
1			CONTAINER	EV (121070, DCM, “Findings”)	1	M		
2	>	HAS CONCEPT MOD	CODE	(CAP, 99SIEMENS, “Clinical Application Package”)	1	M		CID Clinical Application Packages
3	>	CONTAINS	CONTAINER	DT (125007, DCM, “Measurement Group”)	1-n	M		

	NL	Rel with Parent	VT	Concept Name	VM	Req Type	Condition	Value Set Constraint
4	>>	CONTAINS	INCLUDE	DTID (5203) Echo Measurement	1-n	M		Defined by each CAP

Private CID Clinical Application Packages

Coding Scheme Designator (0008,0102)	Code Value (0008,0100)	Code Meaning (0008,0104)
99SIEMENS	LVAnalysis	Left Ventricular Analysis
99SIEMENS	3DPISA	3D PISA
99SIEMENS	ValvesAnalysis	Valves Analysis

9.1.8.1 CAP: Left Ventricular Analysis

Mean	Label	Units	Code Meaning (Coding Scheme Designator, Code Value)	Modifiers
Left Ventricular Analysis			Container: Findings (DCM, 121070)	Clinical Application Package: Left Ventricular Analysis (99SIEMENS, LVAnalysis)
X	DDI 16	%	Diastolic Dyssynchrony Index (16 segment ASE model) (99SIEMENS, DDI16)	
X	DDI 17	%	Diastolic Dyssynchrony Index (17 segment ASE model) (99SIEMENS, DDI17)	
X	DISPED 16	%	Dispersion End Diastole (16 segment ASE model) (99SIEMENS, DISPED16)	
X	DISPED 17	%	Dispersion End Diastole (17 segment ASE model) (99SIEMENS, DISPED17)	
X	DISPES 16	%	Dispersion End Systole (16 segment ASE model) (99SIEMENS, DISPES16)	
X	DISPES 17	%	Dispersion End Systole (17 segment ASE model) (99SIEMENS, DISPES17)	
X	EDSI	%	End Diastolic Sphericity Index (99SIEMENS, EDSI)	
X	ESSI	%	End Systolic Sphericity Index (99SIEMENS, ESSI)	
X	EF	%	Left Ventricular Ejection Fraction (LN, 18043-0)	
X	EDV	ml	Left Ventricular End Diastolic Volume (LN, 18026-5)	
X	ESV	ml	Left Ventricular End Systolic Volume (LN, 18148-7)	
X	MED 16	%	Mean ED time (16 segment ASE model) (99SIEMENS, MED16)	
X	MED 17	%	Mean ED time (17 segment ASE model) (99SIEMENS, MED17)	
X	MES 16	%	Mean ES time (16 segment ASE model) (99SIEMENS, MES16)	

Mean	Label	Units	Code Meaning (Coding Scheme Designator, Code Value)	Modifiers
X	MES 17	%	Mean ES time (17 segment ASE model) (99SIEMENS, MES17)	
X	Post Contr 16	ml*% or ml*ms	Post-contraction Time Volume (16 segment ASE model) (99SIEMENS, PostContr16)	
X	Post Contr 17	ml*% or ml*ms	Post-contraction Time Volume (17 segment ASE model) (99SIEMENS, PostContr17)	
X	Post Relax 16	ml*% or ml*ms	Post-relaxation Time Volume (16 segment ASE model) (99SIEMENS, PostRelax16)	
X	Post Relax 17	ml*% or ml*ms	Post-relaxation Time Volume (17 segment ASE model) (99SIEMENS, PostRelax17)	
X	Pre Contr 16	ml*% or ml*ms	Pre-contraction Time Volume (16 segment ASE model) (99SIEMENS, PreContr16)	
X	Pre Contr 17	ml*% or ml*ms	Pre-contraction Time Volume (17 segment ASE model) (99SIEMENS, PreContr17)	
X	Pre Relax 16	ml*% or ml*ms	Pre-relaxation Time Volume (16 segment ASE model) (99SIEMENS, PreRelax16)	
X	Pre Relax 17	ml*% or ml*ms	Pre-relaxation Time Volume (17 segment ASE model) (99SIEMENS, PreRelax17)	
X	SV	ml	Stroke Volume (SRT, F-32120)	
X	SDI 16	%	Systolic Dyssynchrony Index (16 segment ASE model) (99SIEMENS, SDI16)	
X	SDI 17	%	Systolic Dyssynchrony Index (17 segment ASE model) (99SIEMENS, SDI17)	

9.1.8.2 CAP: 3D PISA

The Clinical Application Package (CAP) SR structure for 3D PISA results is defined below.

Mean	Label	Units	Code Meaning (Coding Scheme Designator, Code Value)	Modifiers
3D PISA			Container: Findings (DCM, 121070)	Clinical Application Package: 3D PISA (99SIEMENS, 3DPISA)
			Container: Measurement Group (DCM, 125007)	Finding Site: Aortic Valve (SRT, T-354000), for Aortic Regurgitation measurements or Mitral Valve (SRT, T-353000), for Mitral Regurgitation measurements or Pulmonic Valve (SRT, T-352000), for Pulmonary Regurgitation measurements or Tricuspid Valve (SRT, T-35100), for Tricuspid Regurgitation measurements <valve> is Aortic Regurgitation, Mitral Regurgitation, Pulmonary Regurgitation, or Tricuspid Regurgitation
X	<valve> Current: Aliasing Velocity	m/s	Alias velocity (LN, 59130-5)	Flow Direction: Regurgitant Flow (SRT, R-42E61)
	<valve> Peak: Aliasing Velocity	m/s	Alias velocity (LN, 59130-5)	Derivation: Maximum (SRT, G-A437) Flow Direction: Regurgitant Flow (SRT, R-42E61)
X	<valve> Current: ERO	cm2	Cardiovascular Orifice Area (SRT, G-038E)	Flow Direction: Regurgitant Flow (SRT, R-42E61)
	<valve> Peak: ERO	cm2	Cardiovascular Orifice Area (SRT, G-038E)	Derivation: Maximum (SRT, G-A437) Flow Direction: Regurgitant Flow (SRT, R-42E61)
X	<valve> Current: Volume PISA	cm2	Flow Area (LN, 20226-7)	Flow Direction: Regurgitant Flow (SRT, R-42E61)
	<valve> Peak: Volume PISA	cm2	Flow Area (LN, 20226-7)	Derivation: Maximum (SRT, G-A437) Flow Direction: Regurgitant Flow (SRT, R-42E61)
X	<valve> Current: Inst. Flow Rate	ml/s	Peak Instantaneous Flow Rate (LN, 34141-2)	Flow Direction: Regurgitant Flow (SRT, R-42E61)
	<valve> Peak: Inst. Flow Rate	ml/s	Peak Instantaneous Flow Rate (LN, 34141-2)	Derivation: Maximum (SRT, G-A437) Flow Direction: Regurgitant Flow (SRT, R-42E61)
X	<valve> Current: Peak Regurg Vol	ml	Volume using PISA (99SIEMENS, VolumePISA)	Flow Direction: Regurgitant Flow (SRT, R-42E61)
	<valve> Peak: Peak Regurg Vol	ml	Volume using PISA (99SIEMENS, VolumePISA)	Derivation: Maximum (SRT, G-A437) Flow Direction: Regurgitant Flow (SRT, R-42E61)

9.1.8.3 CAP: Valves Analysis

The Clinical Application Package (CAP) SR structure for Valves Analysis results is defined below.
[AV] = Aortic Valve
[MV] = Mitral Valve

Mean	Label	Units	Code Meaning (Coding Scheme Designator, Code Value)	Modifiers
Valves Analysis			Container: Findings (DCM, 121070)	Clinical Application Package: Valves Analysis (99SIEMENS, ValvesAnalysis)
			Container: Measurement Group (DCM, 125007)	
X	[AV] AV-MV Angle [MV] AV-MV Angle	deg	AV-MV Angle (99SIEMENS, AVMVAngle)	
X	[AV] AV-MV Centroid Distance [MV] AV-MV Centroid Distance	mm	AV-MV Centroid Distance (99SIEMENS, AVMVCentroidDist)	
			Container: Measurement Group (DCM, 125007)	Finding Site: Aortic Valve (SRT, T-35400)
X	[AV] Valve Orifice Area	mm2	Cardiovascular Orifice Area (SRT, G-038E)	
X	[AV] Ann Area	mm2	Area (SRT, G-A166)	Finding Site: Aortic Valve Ring (SRT, T-35410)
X	[AV] Ann Diam (Area Derived)	mm	Diameter (SRT, M-02550)	Measurement Method: Derived from Area (99SIEMENS, AreaDerived) Finding Site: Aortic Valve Ring (SRT, T-35410)
X	[AV] Ann Diam (Perimeter Derived)	mm	Diameter (SRT, M-02550)	Measurement Method: Derived from Perimeter (99SIEMENS, PerimeterDerived) Finding Site: Aortic Valve Ring (SRT, T-35410)
X	[AV] Ann Perimeter	mm	Perimeter (SRT, G-A197)	Finding Site: Aortic Valve Ring (SRT, T-35410)
X	[AV] Root SoV Perimeter	mm	Perimeter (SRT, G-A197)	Finding Site: Structure Sinus of Valsalva (SRT, T-42200)
X	[AV] Root STJ Perimeter	mm	Perimeter (SRT, G-A197)	Finding Site: Aortic Sinotubular Junction (SRT, T-42102)
X	[AV] Root SoV Area	mm2	Vessel lumen cross-sectional area (SRT, G-0366)	Finding Site: Structure Sinus of Valsalva (SRT, T-42200)
X	[AV] Root STJ Area	mm2	Vessel lumen cross-sectional area (SRT, G-0366)	Finding Site: Aortic Sinotubular Junction (SRT, T-42102)

Mean	Label	Units	Code Meaning (Coding Scheme Designator, Code Value)	Modifiers
X	[AV] Root SoV Diam (Area Derived)	mm	Vessel lumen diameter (SRT, G-0364)	Measurement Method: Derived from Area (99SIEMENS, AreaDerived) Finding Site: Structure Sinus of Valsalva (SRT, T-42200)
X	[AV] Root SoV Diam (Perimeter Derived)	mm	Vessel lumen diameter (SRT, G-0364)	Measurement Method: Derived from Perimeter (99SIEMENS, PerimeterDerived) Finding Site: Structure Sinus of Valsalva (SRT, T-42200)
X	[AV] Root STJ Diam (Area Derived)	mm	Vessel lumen diameter (SRT, G-0364)	Measurement Method: Derived from Area (99SIEMENS, AreaDerived) Finding Site: Aortic Sinotubular Junction (SRT, T-42102)
X	[AV] Root STJ Diam (Perimeter Derived)	mm	Vessel lumen diameter (SRT, G-0364)	Measurement Method: Derived from Perimeter (99SIEMENS, PerimeterDerived) Finding Site: Aortic Sinotubular Junction (SRT, T-42102)
X	[AV] Ann Max Diam	mm	Maximum Diameter (99SIEMENS, MaxDiam)	Finding Site: Aortic Valve Ring (SRT, T-35410)
X	[AV] Root SoV Max Diam	mm	Maximum Diameter (99SIEMENS, MaxDiam)	Finding Site: Structure Sinus of Valsalva (SRT, T-42200)
X	[AV] Root STJ Max Diam	mm	Maximum Diameter (99SIEMENS, MaxDiam)	Finding Site: Aortic Sinotubular Junction (SRT, T-42102)
X	[AV] Ann Min Diam	mm	Minimum Diameter (99SIEMENS, MinDiam)	Finding Site: Aortic Valve Ring (SRT, T-35410)
X	[AV] Root SoV Min Diam	mm	Minimum Diameter (99SIEMENS, MinDiam)	Finding Site: Structure Sinus of Valsalva (SRT, T-42200)
X	[AV] Root STJ Min Diam	mm	Minimum Diameter (99SIEMENS, MinDiam)	Finding Site: Aortic Sinotubular Junction (SRT, T-42102)
X	[AV] Avg Root Height	mm	Average Height (99SIEMENS, AvgHeight)	Finding Site: Aortic Root (SRT, F-04403)
X	[AV] Max Root Height	mm	Maximum Height (99SIEMENS, MaxHeight)	Finding Site: Aortic Root (SRT, F-04403)
X	[AV] Min Root Height	mm	Minimum Height (99SIEMENS, MinHeight)	Finding Site: Aortic Root (SRT, F-04403)
X	[AV] Coapt Height	mm	Aortic Valve Coaptation Height (99SIEMENS, AVCoaptationHt)	Cardiac Cycle Point: End Diastole (SRT, F-32011)
X	[AV] Interostia Angle	deg	Aortic Valve Interostia Angle (99SIEMENS, AVIntrostiaAngle)	
X	[AV] LR Intercomm Angle	deg	Aortic Valve Left to Right Intercommissural Angle (99SIEMENS, LRInterCommAngle)	
X	[AV] NL Intercomm Angle	deg	Aortic Valve Non-coronary to Left Intercommissural Angle (99SIEMENS, NLInterCommAngle)	

Mean	Label	Units	Code Meaning (Coding Scheme Designator, Code Value)	Modifiers
X	[AV] RN Intercomm Angle	deg	Aortic Valve Right to Non-coronary Intercommissural Angle (99SIEMENS, RNInterCommAngle)	
			Container: Measurement Group (DCM, 125007)	Finding Site: Aortic Valve (SRT, T-35400) Topographical modifier: Left (SRT, G-A101)
X	[AV] L Leaflet Height	mm	Height (DCM, 121207)	
X	[AV] Ann L Hinge Diam	mm	Hinge Diameter (99SIEMENS, HingeDiam)	Finding Site: Aortic Valve Ring (SRT, T-35410)
X	[AV] L Intercomm Dist	mm	Aortic Valve Intercommissural Distance (99SIEMENS, AVInterCommDist)	
X	[AV] L Leaflet Edge Length	mm	Aortic Valve Leaflet Edge Length (99SIEMENS, AVLeafletEdgeLen)	
X	[AV] L Leaflet Edge Length/Height	unitless	Aortic Valve Leaflet Edge to Height Ratio (99SIEMENS, AVLeafEdgHtRatio)	
X	[AV] L Ostium Height	mm	Coronary Ostium Height (99SIEMENS, CorOstiumHeight)	
			Container: Measurement Group (DCM, 125007)	Finding Site: Aortic Valve (SRT, T-35400) Topographical modifier: Non-coronary (99SIEMENS, Noncoronary)
X	[AV] N Leaflet Height	mm	Height (DCM, 121207)	
X	[AV] Ann N Hinge Diam	mm	Hinge Diameter (99SIEMENS, HingeDiam)	Finding Site: Aortic Valve Ring (SRT, T-35410)
X	[AV] N Intercomm Dist	mm	Aortic Valve Intercommissural Distance (99SIEMENS, AVInterCommDist)	
X	[AV] N Leaflet Edge Length	mm	Aortic Valve Leaflet Edge Length (99SIEMENS, AVLeafletEdgeLen)	
X	[AV] N Leaflet Edge Length/Height	unitless	Aortic Valve Leaflet Edge to Height Ratio (99SIEMENS, AVLeafEdgHtRatio)	
			Container: Measurement Group (DCM, 125007)	Finding Site: Aortic Valve (SRT, T-35400) Topographical modifier: Right (SRT, G-A100)
X	[AV] R Leaflet Height	mm	Height (DCM, 121207)	
X	[AV] Ann R Hinge Diam	mm	Hinge Diameter (99SIEMENS, HingeDiam)	Finding Site: Aortic Valve Ring (SRT, T-35410)
X	[AV] R Intercomm Dist	mm	Aortic Valve Intercommissural Distance (99SIEMENS, AVInterCommDist)	
X	[AV] R Leaflet Edge Length	mm	Aortic Valve Leaflet Edge Length (99SIEMENS, AVLeafletEdgeLen)	
X	[AV] R Leaflet Edge Length/Height	unitless	Aortic Valve Leaflet Edge to Height Ratio (99SIEMENS, AVLeafEdgHtRatio)	

Mean	Label	Units	Code Meaning (Coding Scheme Designator, Code Value)	Modifiers
X	[AV] R Ostium Height	mm	Coronary Ostium Height (99SIEMENS, CorOstiumHeight)	
			Container: Measurement Group (DCM, 125007)	Finding Site: Mitral Valve (SRT, T-35300)
X	[MV] Valve Orifice Area	mm2	Cardiovascular Orifice Area (SRT, G-038E)	
X	[MV] Ann Area	mm2	Area (SRT, G-A166)	Finding Site: Mitral Annulus (SRT, T-35313)
X	[MV] Ann AP Diam	mm	Diameter (SRT, M-02550)	Finding Site: Mitral Annulus (SRT, T-35313) Measurement Orientation: Anterior-Posterior (DCM, 122675)
X	[MV] Ann Height	mm	Height (DCM, 121207)	Finding Site: Mitral Annulus (SRT, T-35313)
X	[MV] Total Ann Perimeter	mm	Perimeter (SRT, G-A197)	Finding Site: Mitral Annulus (SRT, T-35313)
X	[MV] A1-P1 Coapt Height	mm	Mitral Valve A1-P1 Coaptation Segmental Height (99SIEMENS, A1P1CoaptSegHt)	
X	[MV] A1-P1 Flail Gap	mm	Mitral Valve A1-P1 Flail Segmental Gap (99SIEMENS, A1P1FlailSegGap)	
X	[MV] A1-P1 Tenting Height	mm	Mitral Valve A1-P1 Tenting Segmental Height (99SIEMENS, A1P1TentingSegHt)	
X	[MV] A2-P2 Coapt Height	mm	Mitral Valve A2-P2 Coaptation Segmental Height (99SIEMENS, A2P2CoaptSegHt)	
X	[MV] A2-P2 Flail Gap	mm	Mitral Valve A2-P2 Flail Segmental Gap (99SIEMENS, A2P2FlailSegGap)	
X	[MV] A2-P2 Tenting Height	mm	Mitral Valve A2-P2 Tenting Segmental Height (99SIEMENS, A2P2TentingSegHt)	
X	[MV] A3-P3 Coapt Height	mm	Mitral Valve A3-P3 Coaptation Segmental Height (99SIEMENS, A3P3CoaptSegHt)	
X	[MV] A3-P3 Flail Gap	mm	Mitral Valve A3-P3 Flail Segmental Gap (99SIEMENS, A3P3FlailSegGap)	
X	[MV] A3-P3 Tenting Height	mm	Mitral Valve A3-P3 Tenting Segmental Height (99SIEMENS, A3P3TentingSegHt)	
X	[MV] Ann AP Diam/AL-PM Diam	unitless	Mitral Valve Annulus AP Diameter/AL-PM Diameter Ratio (99SIEMENS, AAPALPMDiamRatio)	
X	[MV] Ann Height/AL-PM Comm Diam	unitless	Mitral Valve Annulus Height/AL-PM Commissural Diameter Ratio (99SIEMENS, AHtALPMDiamRatio)	
X	[MV] Ann AL-PM Diameter	mm	Mitral Valve Anterolateral-Posteromedial Diameter (99SIEMENS, ALPMDiam)	Finding Site: Mitral Annulus (SRT, T-35313)
X	[MV] Avg Coapt Height	mm	Mitral Valve Coaptation Average Height (99SIEMENS, MVCoaptAvgHt)	

Mean	Label	Units	Code Meaning (Coding Scheme Designator, Code Value)	Modifiers
X	[MV] Avg Flail Gap	mm	Mitral Valve Average Flail Gap (99SIEMENS, MVAvgFlailGap)	
X	[MV] Avg Tenting Height	mm	Mitral Valve Average Tenting Height (99SIEMENS, MVAvgTentingHt)	
X	[MV] Intercomm Dist	mm	Mitral Valve Intercommissural Distance (99SIEMENS, InterCommDist)	
X	[MV] Intertrigonal Dist	mm	Mitral Valve Intertrigonal Distance (99SIEMENS, IntertrigDist)	
X	[MV] Max Flail Gap	mm	Mitral Valve Maximum Flail Gap (99SIEMENS, MVMaxFlailGap)	
X	[MV] Max Tenting Height	mm	Mitral Valve Maximum Tenting Height (99SIEMENS, MVMaxTentingHt)	
X	[MV] A1-P1 Tenting Area	mm2	Mitral Valve A1-P1 Tenting Area (99SIEMENS, MVA1P1TentArea)	
X	[MV] A2-P2 Tenting Area	mm2	Mitral Valve A2-P2 Tenting Area (99SIEMENS, MVA2P2TentArea)	
X	[MV] A3-P3 Tenting Area	mm2	Mitral Valve A3-P3 Tenting Area (99SIEMENS, MVA3P3TentArea)	
X	[MV] Nonplanarity Angle	deg	Mitral Valve Nonplanarity Angle (99SIEMENS, NonplanrtyAngle)	Finding Site: Mitral Annulus (SRT, T-35313)
X	[MV] Prolapse Area	mm2	Mitral Valve Prolapse Area (99SIEMENS, MVProlapseArea)	
X	[MV] Avg Tenting Area	mm2	Mitral Valve Average Tenting Area (99SIEMENS, MVAvgTentArea)	
X	[MV] Prolapse Volume	ml	Mitral Valve Prolapse Volume (99SIEMENS, MVProlapseVol)	
X	[MV] Total Leaflet Area	mm2	Mitral Valve Total Leaflet Area (99SIEMENS, MVTotalLeafArea)	
X	[MV] Max Tenting Area	mm2	Mitral Valve Maximum Tenting Area (99SIEMENS, MVMaxTentArea)	
X	[MV] Min Tenting Area	mm2	Mitral Valve Minimum Tenting Area (99SIEMENS, MVMinTentArea)	
			Container: Measurement Group (DCM, 125007)	Finding Site: Mitral Valve (SRT, T-35300) Topographical modifier: Anterior (SRT, G-A105)
X	[MV] Ant Leaflet Area	mm2	Area (SRT, G-A166)	
X	[MV] A1 Area	mm2	Area (SRT, G-A166)	Finding Site: A1 Leaflet Segment (99SIEMENS, A1LeafletSegment)
X	[MV] A2 Area	mm2	Area (SRT, G-A166)	Finding Site: A2 Leaflet Segment (99SIEMENS, A2LeafletSegment)
X	[MV] A3 Area	mm2	Area (SRT, G-A166)	Finding Site: A3 Leaflet Segment (99SIEMENS, A3LeafletSegment)

Mean	Label	Units	Code Meaning (Coding Scheme Designator, Code Value)	Modifiers
X	[MV] A1 Length	mm	Length (SRT, G-A22A)	Finding Site: A1 Leaflet Segment (99SIEMENS, A1LeafletSegment)
X	[MV] A2 Length	mm	Length (SRT, G-A22A)	Finding Site: A2 Leaflet Segment (99SIEMENS, A2LeafletSegment)
X	[MV] A3 Length	mm	Length (SRT, G-A22A)	Finding Site: A3 Leaflet Segment (99SIEMENS, A3LeafletSegment)
X	[MV] Ant Ann Perimeter	mm	Perimeter (SRT, G-A197)	Finding Site: Mitral Annulus (SRT, T-35313)
X	[MV] Avg Ant Leaflet Length	mm	Mitral Valve Leaflet Average Length (99SIEMENS, MVLeafletAvgLen)	
X	[MV] Max Ant Leaflet Length	mm	Mitral Valve Leaflet Maximum Length (99SIEMENS, MVLeafletMaxLen)	
			Container: Measurement Group (DCM, 125007)	Finding Site: Mitral Valve (SRT, T-35300) Topographical modifier: Posterior (SRT, G-A106)
X	[MV] Post Leaflet Area	mm2	Area (SRT, G-A166)	
X	[MV] P1 Area	mm2	Area (SRT, G-A166)	Finding Site: P1 Leaflet Segment (99SIEMENS, P1LeafletSegment)
X	[MV] P2 Area	mm2	Area (SRT, G-A166)	Finding Site: P2 Leaflet Segment (99SIEMENS, P2LeafletSegment)
X	[MV] P3 Area	mm2	Area (SRT, G-A166)	Finding Site: P3 Leaflet Segment (99SIEMENS, P3LeafletSegment)
X	[MV] P1 Length	mm	Length (SRT, G-A22A)	Finding Site: P1 Leaflet Segment (99SIEMENS, P1LeafletSegment)
X	[MV] P2 Length	mm	Length (SRT, G-A22A)	Finding Site: P2 Leaflet Segment (99SIEMENS, P2LeafletSegment)
X	[MV] P3 Length	mm	Length (SRT, G-A22A)	Finding Site: P3 Leaflet Segment (99SIEMENS, P3LeafletSegment)
X	[MV] Post Ann Perimeter	mm	Perimeter (SRT, G-A197)	Finding Site: Mitral Annulus (SRT, T-35313)
X	[MV] Avg Post Leaflet Length	mm	Mitral Valve Leaflet Average Length (99SIEMENS, MVLeafletAvgLen)	
X	[MV] Max Post Leaflet Length	mm	Mitral Valve Leaflet Maximum Length (99SIEMENS, MVLeafletMaxLen)	